



**CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
ENGINEERING & CONSTRUCTION DIVISION**

**PROJECT MANUAL
11th Street Odor Control Facility
WBS No. R-000020-0010-4**

VOLUME 1 of 1

Divisions 00 through 17

February 2015



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Houston, TX 77042
713-464-2724
TBPE Registered Firm No. F-13



Document 00010

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NOTE: Bold capitalized Specification Sections are included in the City of Houston Department of Public Works and Engineering Standard Construction Specifications for Wastewater Collection Systems, Water Lines, Storm Drainage, Street Paving, and Traffic located here: http://documents.publicworks.houstontx.gov/document-center/cat_view/88-engineering-and-construction/92-specifications/208-division-02-16-standard-specifications.html; and are incorporated in Project Manuals by reference as if copied verbatim. Documents listed "for filing" are to be provided by Bidder and are not included in this Project Manual unless indicated for example only. The Document numbers and titles hold places for actual documents to be submitted by Contractor during Bid, post-bid, or construction phase of the Project. Specification Sections marked with an asterisk (*) are amended by a supplemental specification, printed on blue paper and placed in front of the Specification it amends. Documents in the 200, 300 and 400 series of Division 00, except for Document 00410B – Bid Form, Part B, are not part of the Contract.

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LIST OF PRE-QUALIFIED ASBESTOS/LEAD ABATEMENT, MOLD & SOIL REMEDIATION,
DEMOLITION AND PETROLEUM STORAGE TANK REMOVAL CONTRACTORS

1.01 DOCUMENT INCLUDES

- A. Authorization
- B. List of Authorized Contractors.

2.0 RELATED DOCUMENTS

- A. Section 13280 – Hazardous Materials Remediation
- B. Section 13281&13282 – Abatement of Asbestos/Lead Containing Materials

3.0 AUTHORIZATION

- A. The list of Contractors Pre-qualified for Asbestos/Lead Abatement, Mold & Soil Remediation, Demolition & Petroleum Storage Tank Removal ("List") was authorized on March 21, 2012, by City of Houston Council Motion No. 12-0180.
- B. Only those firms on the List can be utilized by Bidder in subcontracting for asbestos & lead abatement, mold & soil remediation, demolition & petroleum storage tank removal included in the Work.
- C. The List is administered by General Services Department. All inquiries should be directed to Gabriel Mussio (832-393-8079).

4.0 LIST OF AUTHORIZED CONTRACTORS

- A. As of the date specified in paragraph 3.0.A., all contractors listed in paragraph 4.0.B were licensed in the State of Texas for the type of work. Authorized Contractors must maintain there license to be on the list.
- B. Authorized Contractors:
 - 1. AAR Incorporated, 6640 Signat Drive, Houston, Texas 77041
 - 2. A & M Environmental, LLC, 6536 Supply Row, Houston, Texas 77011
 - 3. ARC Abatement Inc., 6827 Signat Drive, Houston, Texas 77041
 - 4. AIA General Contractors, Inc., 18331 Running Vine Lane, Spring, Texas 77379
 - 5. Arrow Services, Inc., 10202 Airline Drive, Suite A, Houston, Texas 77037
 - 6. Basic Environmental Group, LLC., 1839 Key Biscayne Court, Houston,

Texas 77065

7. Cherry Environmental Services, Inc., 4501 Cherry Lane, Santa Fe, Texas 77517
8. Clark-Tech Environmental Systems, Inc., 1515 Globe Street, Houston, Texas 77034
9. CRG Environmental Services, LLC., 2504 Avenue I, Rosenberg, Texas 77471
10. DNB Enterprises, Inc., 12969 West Hardy, Houston, Texas 77037
11. Dunphay Petroleum Services, Inc., 3505 Daphne, Houston, Texas 77021
12. EC Government Services, 5850 San Felipe, Suite 400, Houston, Texas 77057
13. Effective Environmental, Inc., 9950 Chemical Road, Pasadena, Texas 77507
14. GenTech Construction Company, LLC., 2211 West 34th Street, Houston, Texas 77018
15. Hazard Assessment Leaders, Inc., dba HAL, Inc., 5311 Petty Street, Houston, Texas 77007
16. Inland Environmental, Ltd., PO Box 6751, Kingwood, Texas 77325
17. J.T.B. Services, Inc., 9026 Lambright, Houston, Texas 77075
18. NCM, 16421 Aldine Westfield Road, Houston, Texas 77032
19. PfP Abatement Group, LLC., 3823 Shadow Trail Drive, Houston, Texas 77084
20. PEMCO, Inc., PO Box 2009, Pearland, Texas 77588-2009
21. RNDI Companies, Inc., 2255 Ridge Road, Suite 216, Rockwell, Texas 75807
22. Separation Systems Consultants, Inc., 17041 El Camino Real, Suite 200 Houston, Texas 77058
23. Texas Environmental Control, Inc., 4623 Steffani Lane, Houston, Texas 77041
24. Weston Solutions, Inc., 5599 San Felipe, Suite 700, Houston, Texas 77056

25. 1 Priority Environmental Services, Inc., 2573 Gravel Drive, Fort
Worth, Texas 76118

END OF DOCUMENT

List of Changes:

04-30-2004: Added List of Changes, Notice to Bidders Section. Defined new term (Code). Provided information on how errors in extending unit prices and totaling alternates would be handled. Changed document number for Notice of Intent to Award.

12-10-2004: Corrected paragraph references in Paragraphs 6.0.B, 11.0.B.2 and 11.0.C.3.

02-28-2006: Deleted Paragraphs 9.0.D and 9.0.J. Guidance on how to handle math errors in Bid Form is provided in tabular form in Document 00210 – Supplementary Instructions to Bidders.

08-10-2006: Added Small Business Enterprise (SBE) title and DBE to Paragraph 12.0 B.

04-12-2013: Added required no-contact/quiet period language as Paragraph 3.0 C., drawn from the City Procurement Manual.

02-26-2014: Add the updated no-contact/quiet period language as Paragraph 3.0 C., again drawn from the City Procurement Manual.

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INSTRUCTIONS TO BIDDERS

1.0 RELATED DOCUMENTS

- A. Document 00210 – Supplementary Instructions to Bidders.
- B. Document 00320 – Geotechnical Information.
- C. Document 00330 – Existing Conditions.
- D. Document 00410 – Bid Form, Parts A & B.
- E. Document 00495 – Post-Bid Procedures.
- F. Document 00520 – Agreement.
- G. Document 00700 – General Conditions.
- H. Document 00800 – Supplementary Conditions.

2.0 DEFINITIONS

- A. Definitions set forth in Document 00700 – General Conditions and in other documents of Project Manual, are applicable to Bid Documents.
- B. *Addendum*: Written or graphic instrument issued prior to Bid opening, which clarifies, modifies, corrects, or changes Bid Documents.
- C. *Alternate*: The total amount bid for additions to work, as described in Section 01110 – Summary of Work. Each Alternate includes cost of effects on adjacent or related components, and Bidder's overhead and profit.
- D. *Bid*: A complete and properly signed offer to perform the Work in accordance with this Document and Document 00210 – Supplementary Instructions to Bidders.
- E. *Bid Date*: Date and time set for receipt of Bids as stated in Document 00210 – Supplementary Instructions to Bidders, or as modified by Addenda.
- F. *Bid Documents*: Project Manual, Drawings, and Addenda.
- G. *Bid Supplement*: A Bid submittal that is required in Document 00410 – Bid Form.
- H. *Bidder*: Person or firm, identified in Document 00410B – Bid Form – Part B, including its successors, and its authorized representative.

- I. *Code*: Code of Ordinances, Houston, Texas.
- J. *Low Bidder*: Apparent successful Bidder that qualifies as a responsible Bidder and that submits Bid with lowest Total Bid Price.
- K. *Project Manager*: Person designated in Document 00100 – Advertisement for Bids and Document 00220 – Request for Bid Information to represent the City during bidding and post-bid periods.
- L. *Project Manual*: Volume assembled for the Work that includes the bidding requirements, sample forms, Conditions of the Contract, and Specifications.
- M. *Security Deposit*: A certified check, cashier's check, or bid bond in the amount of 10 percent of the Total Bid Price.
- N. *Total Bid Price*: Total amount bid for performing the Work as identified by Bidder in Document 00410B – Bid Form – Part B, which amount includes:
 - 1. Stipulated Price;
 - 2. Total Base Unit Prices;
 - 3. Total Extra Unit Prices;
 - 4. Total Cash Allowances; and
 - 5. Total Alternates.

3.0 NOTICE TO BIDDERS

- A. The City of Houston Fair Campaign Ordinance makes it unlawful for a Contractor to offer any contribution to a candidate for City elective office (including elected officers and officers-elect) during a certain period of time prior to and following the award of the Contract by the City Council. The term "Contractor" includes proprietors of proprietorships, all partners of partnerships, and all officers, directors, and holders of 10 percent or more of the outstanding shares of corporations. A statement disclosing the names and business addresses of each of those persons will be required to be submitted with each bid or proposal; for a City Contract. Bidder shall complete and submit Document 00452 – Form A, Contractor Submission List, City of Houston Fair Campaign Ordinance, with its Bid to comply with this requirement. See Chapter 18 of the Code for further information.

B. Chapter 15, Article VIII, of the City's Code provides that no contract shall be let, nor any other business transaction entered into, by the City with any person indebted to the City or a qualifying entity, if the contractor or transaction comes within the provisions of Section 15-1 (c) of the Code. Exceptions are provided in Section 15-126 of the Code. Bidder shall complete and submit Document 00455 – Affidavit of Ownership or Control, with its Bid to comply with this requirement.

C. Neither bidder(s) nor any person acting on bidder(s)'s behalf shall attempt to influence the outcome of the award by the offer, presentation or promise of gratuities, favors, or anything of value to any appointed or elected official or employee of the City of Houston, their families or staff members. All inquiries regarding the solicitation are to be directed to the designated City Representative identified on the first page of the solicitation. Upon issuance of the solicitation through the pre-award phase and up to the date the City Secretary publicly posts notice of any City Council agenda containing the applicable award, aside from bidder's formal response to the solicitation, through the pre-award phase, written requests for clarification during the period officially designated for such purpose by the City Representative, neither bidder(s) nor persons acting on their behalf shall communicate with any appointed or elected official or employee of the City of Houston, their families or staff through written or oral means in an attempt to persuade or influence the outcome of the award or to obtain or deliver information intended to or which could reasonably result in an advantage to any bidder. However, nothing in this paragraph shall prevent a bidder from making public statements to the City Council convened for a regularly scheduled session after the official selection has been made and placed on the City Council agenda for action, or to a City Council committee convened to discuss a recommendation regarding the solicitation.

4.0 *BID DOCUMENTS*

- A. The Bid Documents may be obtained at location specified in Document 00210 – Supplementary Instructions to Bidders.
- B. The Bid Documents are made available only for the purpose of bidding on the Work. Receipt of Bid Documents does not grant a license for other purposes.
- C. On receipt of Bid Documents, Bidder shall verify that documents are legible and complete, compare contents of Project Manual with Document 00010 – Table of Contents, and compare Index of Drawings with Document 00015 – List of Drawings.

Bidder shall notify Project Manager if Bid Documents are incomplete.

D. If City of Houston Standard Specifications or Standard Details are required by the Project Manual, Bidder shall refer to Document 00210 – Supplementary Instructions to Bidders for purchase information.

5.0 *EXAMINATION OF DOCUMENTS, SITE, AND LOCAL CONDITIONS*

A. Bidder shall examine Project site, become familiar with local conditions under which the Work shall be performed, conduct appropriate investigations, and correlate personal observations with requirements of the Bid Documents before submitting a Bid.

B. Bidder shall make site investigations to the extent Bidder deems necessary to ascertain extent of subsurface conditions.

C. Failure of Bidder to perform the investigations prior to submitting a Bid does not relieve Bidder of responsibility for investigations, interpretations and proper use of available information in the preparation of its Bid.

D. Bidder shall observe limitations of access to occupied or restricted site as stated in Document 00210 – Supplementary Instructions to Bidders.

6.0 *INTERPRETATIONS DURING BIDDING*

A. Bidder shall immediately submit Document 00220 – Request for Bid Information to Project Manager upon finding errors, discrepancies, or omissions in Bid Documents. Confirmation of receipt of questions by the City is the responsibility of Bidder. Verbal discussions and answers are not binding.

B. Document 00220 – Request for Bid Information must be received at least 10 days before the Bid Date to allow issuance of Addenda in accordance with Paragraph 7.O.D. Replies, if issued, are by Addenda.

7.0 *ADDENDA*

A. Addenda that affect bidding requirements are applicable only during applicable only through issuance of the Notice to Proceed. Addenda that affect the Contract are a part of the Contract.

B. BIDDERS WHO SUBMIT A BID ON THIS PROJECT SHALL BE PRESUMED TO HAVE RECEIVED ALL ADDENDA AND TO HAVE INCLUDED ANY COST THEREOF IN THEIR BIDS, REGARDLESS OF WHETHER THEY ACKNOWLEDGE THE ADDENDA OR NOT.

- C. The City will make Addenda available at same location where the Bid Documents may be obtained. The City will notify plan holders of record when Addenda are available. Bidders are responsible for obtaining Addenda after notification.
- D. No Addendum will be issued later than noon on Monday before Bid Date, except Addenda with minor clarifications, withdrawing request for Bids, or postponing Bid Date.

8.0 *SUBSTITUTION OF PRODUCTS*

- A. No substitutions of Products will be considered during the bidding period.

9.0 *PREPARATION OF BIDS*

- A. Bidder shall fill in applicable blanks in Document 00410A&B – Bid Form – Parts A & B and Bid Supplements. In addition, Bidder shall bid all Alternates. Bidder shall properly sign Document 00410B -Bid Form.
- B. Bidder shall initial all pages, except signature page, of Document 00410B – Bid Form – Part B.
- C. Bidder is responsible for all costs incurred by the Bidder, associated with preparation of its Bid and compliance with Post-bid Procedures.
- D. Bidder may not adjust preprinted price on line items stating "Fixed Unit Price" in the description on the Bid Form.
- E. Bidder may increase preprinted price on line items stating "Minimum Bid Price" in the description on the Bid Form by crossing out the minimum and inserting revised price on the line above.
- F. Bidder may decrease preprinted price on line items stating "Maximum Bid Price" in the description on the Bid Form by crossing out the maximum and inserting revised price on the line above.
- G. Bidder shall insert a price no greater than the maximum preprinted range and no less than the preprinted range for line items stating "Fixed Range Unit Price" in the description on the Bid Form by crossing out prices noted and inserting revised price on the line above.
- H. Bidder may not adjust Cash Allowance amounts.

10.0 *BID SUBMISSION*

- A. City Secretary will receive Bids on Bid Date at location specified in Document 00210 –

Supplementary Instructions to Bidders.

- B. Bids submitted after Bid Date will be returned to Bidder unopened.
- C. Verbal, facsimile, or electronic Bids are invalid and will not be considered.
- D. Bidder shall submit in person or by mail one copy of the signed Document 00410 – Bid Form, Parts A and B, along with required Security Deposit, and required Bid Supplements, in a sealed, opaque envelope. In addition, Bidder shall clearly identify Project, Bid Date and Bidder's name on outside of envelope. If forwarded by mail, the sealed envelope containing the Bid must be enclosed in another envelope addressed for postal delivery.

11.0 *BID SECURITY*

- A. Bidder shall submit a Security Deposit with its Bid.
- B. Certified Check or Cashier's Check
 - 1. Bidder shall make check payable to the City of Houston.
 - 2. A check is submitted on the condition that if Bidder is named Low Bidder and fails either to timely and properly submit documents required in Document 00495 – Post-Bid Procedures, the City will cash the check in accordance with Paragraph 11.0.E.
- C. Bid Bond
 - 1. The bid bond must be a valid and enforceable bond, signed by a surety that complies with other requirements set out by law.
 - 2. The bid bond must name the City of Houston as obligee, and be signed by the Bidder as principal and signed and sealed by the surety.
 - 3. The bid bond must be conditioned such that if Bidder is named Low Bidder and then fails to timely and properly submit documents required in Document 00495 – Post-Bid Procedures, surety will be obligated to pay to the City an amount in accordance with Paragraph 11.0.E.
- D. Security Deposits will be retained until after the Contract is awarded or all Bids are rejected.
- E. Low Bidder forfeits Security Deposit if it fails to timely and properly submit documents required in Document 00495 – Post-Bid Procedures. The City may claim an amount equal to the difference between the Total Bid

Price of the defaulting Bidder and the Total Bid Price of the Bidder awarded the Contract. If Security Deposit is a check, the City will reimburse any remaining balance to the defaulting Bidder.

12.0 *SUBCONTRACTORS AND SUPPLIERS*

- A. The City may reject proposed Subcontractors or Suppliers.
- B. Refer to Document 00800 – Supplementary Conditions, for MWBE/PDBE, DBE and SBE goals.

13.0 *MODIFICATION OR WITHDRAWAL OF BID*

- A. A Bidder may modify or withdraw a Bid submitted before the Bid Date by written notice to the City Secretary. The notice may not reveal the amount of the original Bid and must be signed by the Bidder.
- B. Bidder may not modify or withdraw its Bid by verbal, facsimile, or electronic means.
- C. A withdrawn Bid may be resubmitted up to the time designated for receipt of Bids.

14.0 *BID DISQUALIFICATION*

- A. The City may disqualify a Bid if the Bidder:
 - 1. fails to provide required Security Deposit in the proper amount;
 - 2. improperly or illegibly completes information required by the Bid Documents;
 - 3. fails to sign Bid or improperly signs Bid;
 - 4. qualifies its Bid; or
 - 5. improperly submits its Bid.
- B. When requested, Low Bidder shall present satisfactory evidence that Bidder has regularly engaged in performing construction work as proposed, and has the capital, labor, equipment, and material to perform the

Work.

15.0 *PREBID MEETING*

- A. A prebid meeting is scheduled to be held at the place, time, and date listed in Document 00210 – Supplementary Instructions to Bidders.
- B. All Bidders, subcontractors, and suppliers are invited to attend.
- C. Representatives of City Engineer will attend.

16.0 *OPENING OF BIDS*

- A. Bids are opened by the City Secretary and publicly read in City Council Chambers on the Public Level in City Hall Annex at 11:00 a.m. on Bid Date.
- B. Place and date of Bid opening may be changed in accordance with Sections 15-3(b)(5) and 15-3(b)(6) of the City Code.

17.0 *EVALUATION AND CONSIDERATION OF BIDS*

- A. Project Manager will tabulate, record and evaluate Bids.
- B. The City may reject all Bids or may reject any defective Bid.

18.0 *ACCEPTANCE OF THE BID*

- A. The City will send to Low Bidder Document 00498 – Notice of Intent to Award. Acceptance by the City is conditioned upon Bidder's timely and proper submittal of documents required in Document 00495 – Post-Bid Procedures.
- B. The Bid remains open to acceptance and is irrevocable for the period of time stated in Document 00410A – Bid Form – Part A.

END OF DOCUMENT

Document 00210

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

The following Paragraphs modify Document 00200 - Instructions to Bidders. Where a portion of the Instructions to Bidders is modified or deleted by these Supplementary Instructions, the unaltered portions of the Instructions to Bidders remains in effect.

2.0 – DEFINITIONS: Add the following Paragraphs to this Section:

- O. *Office of Business Opportunity (OBO)*: All references to Affirmative Action Contract Compliance Division (AACC) set forth in Document 00700 – General Conditions and in other documents of the Project Manual, shall refer to, and include, the Office of Business Opportunity.

3.0 - NOTICE TO BIDDERS: Add the following Paragraph to this Section:

- C. The City will award this contract to a “Local Business”, as that term is defined in Section 15-176 of the City of Houston Code of Ordinances (“the Code”):
 - If the bid of the Local Business is less than \$100,000 and is the lowest responsible bid or is within 5% of the lowest bid received, or
 - If the bid of the Local Business is more than \$100,000 and is the lowest responsible bid or is within 3% of the lowest bid received, and
 - Unless the Director determines that such an award would unduly interfere with contract needs, as provided in Section 15-181 of the Code.

If there is no bid of a Local Business that meets these criteria, the City will award the contract to the lowest responsible bidder.

4.0 – BID DOCUMENTS: Add the following Paragraphs to this Section:

A. Add the following Paragraph A.1:

- 1. Bid documents may only be obtained electronically at the City’s website:
<http://bidsets.publicworks.houstontx.gov/>.

D. Add the following Paragraph D.1:

- 1. Copies of the City Standard Specifications and Details may be acquired at no cost on the City’s website
http://documents.publicworks.houstontx.gov/document-center/cat_view/88-engineering-and-construction/92-specifications/208-division-02-16-standard-specifications.html

- E. The following plan rooms, whose names, addresses, phone and fax numbers were last updated on April 9, 2007, have been authorized by the City to display Bid Documents for examination:
(Note: The Bid Documents furnished to the plan rooms for examination can be in electronic format, in hard copies, or in any other formats pertaining to each City Contracting Division's discretion.)
1. AMTEK Information Services, Inc., 4001 Sherwood Lane, Houston, TX 77092, 713-956-0100, Fax 713-956-5340, Email: planroom@amtekusa.com
 2. Associated Builders & Contractors, Inc., (ABC), 3910 Kirby, Suite 131, Houston, TX 77098-4151, 713-523-6222, Fax 713-874-0747. Email: lori@abchouston.org
 3. Associated General Contractors (AGC-BB) Building Branch, 3825 Dacoma, Houston, TX 77092-8717, 713-843-3700, Fax 713-843-3701. Email: karla.s@agchouston.org
 4. Associated General Contractors, (AGC-HHUI), Highway, Heavy Utilities and Industrial Branch, 2400 Augusta St., Suite 180, Houston, TX 77057, 713-334-7100, Fax 713-334-7130. Email: houston@agctx.org
(Attention: Mel Keyser)
 5. Construction Information Network, 1225 North Loop West, Suite 550, Houston, TX 77008, 713-868-2233 ext. 329, Fax 866-852-2713. Email: paul.tilford@cnsx.com
 6. F. W. Dodge Corporation, 4101 Greenbriar, Suite 320, Houston, TX 77098, 713-529-4895, Fax 713-524-7639. Email: terrie_harris@mcgraw-hill.com
 7. Hispanic Contractors Association of Houston (HCA-GHA), 11 Parker Road, Suite 7, Houston, TX 77241, 713-699-2732 or 832-754-3705, Fax 713-695-1556, Email: hispaniccontractorsassociation@yahoo.com; or Randymagdalen@yahoo.com
 8. Houston Minority Business Development Center, 2900 Woodridge, Suite 124, Houston, TX 77087, 713-644-0821, Fax 713-644-3523. Email: gtamez@gacompanies.com
 9. Reed Construction Data, 30 Technology Parkway South, Suite 100, Norcross, GA – 30092-8629. Tel. 1-800-424-3996 or 1-800-699-8640; Fax 1-800-317-0870 or 1-800-508-5370.

10. The Builders' Exchange of Texas, Inc., 3910 Kirby, Suite 131, Houston, TX 77098, 210-564-6900, Fax: 210-564-6921, Email: houston@bctx.com

F. Add the following Paragraph F.1:

1. Designation as a City Business or Local Business

To be designated as a City or Local Business for the purpose of the Hire Houston First Program, as set out in Article XI of Chapter 15 of the Houston City Code, a bidder or proposer must submit the Hire Houston First Application and Affidavit to the Director of the Mayor's Office of Business Opportunity (OBO) and receive notice that the designation has been approved prior to submission of a bid or proposal. Submit with your bid a valid official letter from OBO with your designation as a City or Local Business.

5.0 - EXAMINATION OF DOCUMENTS, SITE, AND LOCAL CONDITIONS: Insert the following paragraph:

A. Add the following Paragraph D.1:

1. Work will be performed in public right-of-way. The site may be examined at any time during daylight hours.

9.0 – PREPARATION OF BIDS: Add the following Paragraph I to this Paragraph:

- I. For math errors the City encounters in analyzing Bids, the following guidance will be used:

In the event of a conflict between: The Bid Price is:

- | | |
|---|---|
| 1. Individual Unit Price and Extension of that Unit Price | Individual Unit Price times Estimated Quantity |
| 2. A Unit Price extension and total of Unit Price Extensions | Sum of all Individual Unit Price Extensions |
| 3. Individual Alternate and total of Alternates | Sum of all Individual Alternates |
| 4. Individual subtotals for Stipulated Price, Base Unit Prices, Extra Unit Prices, Contractor Bonus, Cash Allowances, and Alternates; and the Total Bid Price | Sum of Individual subtotals for Stipulated Price, Base Unit Prices, Extra Unit Prices, Contractor Bonus, Cash Allowances and Alternates |

10.0 – BID SUBMISSION: Add the following Paragraph A.1 to this Section:

A. Add the following Paragraph A.1:

1. City Secretary will receive Bids at 900 Bagby, Room P101, Houston, Texas until 10:30 a.m., local time on March 26, 2015.

15.0 – PREBID MEETING: Add the following Paragraph A.1 to this Section:

A. Add the following Paragraph A.1:

1. A Prebid Meeting will be held at 10:30 A.M. on Tuesday, March 10, 2015, in 14th Floor, Conference Room No. 1453 at 611 Walker Street, Houston, Texas 77002.

END OF DOCUMENT

Document 00220

REQUEST FOR BID INFORMATION

PROJECT: 11th Street Odor Control Facility Improvements

PROJECT No.: WBS No. R-000020-0010-4

TO: Akhter Hussain, P.E.
15th Floor
611 Walker, Houston, Texas 77002

Phone No. (832) 395-2294

Fax No. (832) 395-2344

Email Addr. akhter.hussain@houstontx.gov

(Type or Print question legibly; use back if more space is needed)

This request relates to _____ and/or _____
Drawing / Detail No. Specification Section No.

Attachments to this request: _____

Signature

Date

(Type or Print Name)

(Type or Print Company Name)

END OF DOCUMENT

Document 00320

GEOTECHNICAL INFORMATION

1. DOCUMENT INCLUDES
 - A. Soils investigation reports.
 - B. Bidder's responsibilities.
2. RELATED DOCUMENTS
 - A. Document 00340 – Environmental Information
 - B. Section 02260 - Trench Safety Systems
3. SITE INVESTIGATION REPORTS
 - A. In the design and preparation of Contract documents for this Project, the City and Design Consultant have used information in geotechnical reports for the investigation and analysis of soils and subsurface conditions at the Project site.
 - B. An electronic copy of the report for this project is included in a CD-Rom affixed to the inside front cover of the project manual.
 - C. Neither the City nor Design Consultant is responsible for accuracy or completeness of any information or data.
4. GEOTECHNICAL REPORTS
 - A. Report No.: 1140200501 Prepared by (Firm Name): Geotest engineering, Inc.; Title: Geotechnical Investigation: Odor Control Design At 11th Street Facility; Report Date: December 1, 2014 No. of Pages: 38
5. BIDDER RESPONSIBILITIES
 - A. Bidder shall take full responsibility for interpretation and use of information contained in above listed reports for its bidding and construction purposes.
 - B. Bidder may perform additional soils investigations as Bidder deems appropriate.

END OF DOCUMENT

Document 00410A

BID FORM – PART A

To: **The Honorable Mayor and City Council of the City of Houston
City Hall Annex
900 Bagby Street
Houston, Texas 77002**

Project: 11th Street Odor Control Facility Improvements

Project No.: WBS No. R-000020-0010-4

Bidder: _____

(Print or type full name of business entity, such as corporation, LLC, etc)

OFFER

- A. Total Bid Price:** Having examined the Project location and all matters referred to in Bid Documents for the Project, we, the undersigned, offer to enter into a Contract to perform the Work for the Total Bid Price shown on the signature page of this Document
- B. Security Deposit:** Included with the Bid is a Security Deposit in the amount of 10 percent of the Total Bid Price subject to terms described in Document 00200 – Instructions to Bidders.
- C. Period for Bid Acceptance:** This offer is open to acceptance and is irrevocable for 90 days from Bid Date. That period may be extended by mutual written agreement of the City and Bidder.
- D. Addenda:** All Addenda have been received. Modifications to Bid Documents have been considered and all related costs are included in the Total Bid Price.
- E. Bid Supplements:** The following documents are attached:
 - Security Deposit (*as defined in Document 00200 – Instructions to Bidders*)
 - Document 00450 - Bidder's Statement of MWSBE Status
 - Document 00452 - Contractor's Submission List - Fair Campaign Ordinance Form A
 - Document 00453 – Bidder's Statement of Residency (*not required for AIP funded project*)
 - Document 00454 - Affidavit of Non-interest
 - Document 00455 - Affidavit of Ownership or Control
 - Document 00456 - Bidder's Certificate of Compliance with Buy American Program (*required for AIP funded project*)
 - Document 00457 – Conflicts of Interest Questionnaire (CIQ)
 - Document 00458 - Bidder's Certificate Regarding Foreign Trade Restriction (*required for AIP funded project*)
 - Document 00459 - Contractor's Statement Regarding Previous Contracts Subject to EEO (*required for AIP funded project*)
 - Document 00460 – (POP 1) Pay or Play Acknowledgement Form

- [X] Document 00470 – Bidder’s MWSBE Participation Plan *(required unless no MWSBE participation goal is provided in Document 00800 (the “Goal”))*.
 - [X] Document 00471 – Pre-bid Good Faith Efforts *(required if the goal in Bidder’s Participation Plan–Document 00470 is lower than the Goal)*.
 - [X] Document 00472 – Bidder’s Goal Deviation Request *(required if the goal in Bidder’s Participation Plan–Document 00470 is lower than the Goal)*.
 - [X] Others as listed: Valid official letter from OBO with your designation as a City or Local Business *(Bidder’s Participation Hire Houston First)*
-

CONTRACT TIME

- A. If offer is accepted, Contractor shall achieve Date of Substantial Completion within 360 days after Date of Commencement of the Work, subject to adjustments of Contract Time as provided in the Contract.

Document 00410B

BID FORM – PART B

1.0 TOTAL BID PRICE HAS BEEN CALCULATED BY BIDDER, USING THE FOLLOWING COMPONENT PRICES AND PROCESS (PRINT OR TYPE NUMERICAL AMOUNTS):

A. STIPULATED PRICE: \$N/A

B. BASE UNIT PRICE TABLE:

Item No.	Spec Ref.	Base Unit Item Description	Unit of Measure	Est. Qty	Unit Price (this column controls)	Total in Figures
1	01502	Mobilization	LS	1	\$61,500 ⁽¹⁾	\$61,500
2	02220	Demolition and salvage of items in the chemical feed area shall include but not be limited to: Remove and dispose of PVC piping, concrete equipment and shelter pads, emergency eyewash station, and water line. Salvage and store onsite two (2) ferrous sulfate and (1) one calcium nitrate storage tanks, a fourth tank not in service, existing chemical feed pumps and fiberglass shelter. Dwg. CF-001	LS	1		
3	02220	Demolition and salvage of items in the bio-scrubber area shall include but not be limited to: Remove and dispose of concrete equipment support, stairs, buried duct, & duct supports. Salvage two (2) tower-type bio-scrubbers, ducts, control and irrigation systems, and two (2) foul air fans. Dwg. OC-001 & 002	LS	1		
4	02821	Demolish and replace the existing chain link with privacy slat double gate at the site access driveway with a new gate of like construction. Dwg. G-006	LS	1		
5	11264 11330 03315	Furnish and install tower-type bio-scrubber wastewater odorous air treatment system including but not be limited to two vessels, irrigation system, instrumentation & controls, and two foul air fans with concrete support pads, ductwork with dampers, and other accessories to make a complete and operational system. Dwg. OC-001 & 002; I-002	LS	1		

Item No.	Spec Ref.	Base Unit Item Description	Unit of Measure	Est. Qty	Unit Price (this column controls)	Total in Figures
6	05512 03315	Furnish and install an aluminum odor control system power and control platform with access stairs and handrail, concrete pedestal and footings. Dwg. OC-005 & E-005	LS	1		
7	11085 15100 15030	Furnish and install chemical feed equipment including but not limited to two peristaltic pumping systems with all appurtenances for calcium nitrate and ferrous sulfate feeding. Each system mounted on a support framework for attaching to the wall inside the fiberglass shelter. Dwg. CF-001 & CF-002	LS	1		
8	15166 15100 15030	Furnish and install, three (3) vertical, 4,000 gallon cross-linked HDPE double wall storage tanks, each with epoxy coated steel support base. All above ground PVC piping and accessories to complete the chemical systems. Dwg. CF-001, CF-002, CF-004 & D-003	LS	1		
9	13130 05500 15511 15512 05530	Furnish and install, a prefabricated fiberglass enclosure for housing chemical feed equipment, piping, panels, and controls, including an open construction FRP support base, aluminum stairs, handrail, landing and two additional standard steel pipe bollards, emergency eyewash/shower and hose station. Dwg. CF-001, CF-002, CF-004 & D-003	LS	1		
10	16510	Furnish and install yard lighting , 3 new poles with LED lights, conduit, wiring, and terminations and relocate 1 existing light pole Dwg. E-002 & -009	LS	1		
11	16111 16402	Furnish and install 200A/480V service including disconnect, meter, duct bank, conduits, and terminations from pole to odor control panel and duct bank, conduits, junction boxes, wiring and terminations, and instruments for the chemical feed system. Dwg. E-009 & E-014	LS	1		
12	16170	Furnish and install grounding system for the bio-scrubber facilities. Dwg. E-003 & E-009	LS	1		
13	17100 17200	Furnish and install communication system, including but not limited to 46' loan star concrete pole, WiMAX radio, PPU-1 pp, camera, wiring, LED light. Dwgs. E-003 & E-009.	LS	1		

Item No.	Spec Ref.	Base Unit Item Description	Unit of Measure	Est. Qty	Unit Price (this column controls)	Total in Figures
14	01570	Filter fabric barrier for storm water pollution control. Dwgs. G-006 & D-004	LF	300		
15	01570	Hay bales placed for storm water pollution control.	LF	20		
16	02260	Trench safety system all types of soil, all depths over 5 feet.	LF	90		
17	02336	Lime Stabilize subgrade under fan pads and soil around existing odor control system slab. OC-001 & -004	SY	110		
18	02951 03315	Saw cut and remove a 35' X 10' section of reinforced concrete paving at the chemical feed area and replace with like pavement. Dwg. CF-001	SY	40		
20	02506 15030	Buried sched. 80 PVC chemical and water piping from the chemical area through the area of removed pavement. Dwg. CF-001 & CF-003	LF	190		
BASE UNIT PRICE TOTAL:						\$ _____

REST OF PAGE INTENTIONALLY LEFT BLANK

C. EXTRA UNIT PRICE TABLE:

Item No.	Spec Ref.	Base Unit Item Description	Unit of Measure	Est. Qty	Unit Price (this column controls)	Total in Figures
21	01570	Extra Filter fabric barrier for storm water pollution control.	LF	100		
22	01570	Extra Hay bales placed for storm water pollution control.	LF	20		
23	02260	Extra trench safety system.	LF	20		
24	02951 03315	Extra saw cut and concrete removal of reinforced concrete paving and replace with like pavement.	SY	20		
25	02336	Extra Lime Stabilize subgrade	SY	20		
26	02951 03315	Extra concrete pavement.	SY	10		
27	03315	Extra Class "A" concrete installed in place for structures	CY	5		
28	03315	Extra Grade 60 Reinforcing steel in place	LB	2000		
29	02506 15030	Extra buried schedule 80 PVC pipe.	LF	190		
30	15892	Extra 30 inch diameter fiberglass reinforced foul air duct	LF	10		
31	15892	Extra 36 inch diameter fiberglass reinforced foul air duct	LF	10		
32	15892	Extra 42 inch diameter fiberglass reinforced foul air duct	LF	10		
33	15892	Extra 48 inch diameter fiberglass reinforced foul air duct	LF	10		
EXTRA UNIT PRICE TOTAL:						\$ _____

D. CASH ALLOWANCE TABLE:

Item No.	Spec Ref.	Cash Allowance Short Title	Cash Allowance in figures (1)
34	01110	Building Permit	\$ 6,500
35	01110	General Architectural /Landscaping	\$ 10,000
CASH ALLOWANCE TOTAL:			\$ 16,500

E. ALTERNATES TABLE: \$[N/A]

REST OF PAGE INTENTIONALLY LEFT BLANK

F. TOTAL BID PRICE:\$ _____
(Add Totals for Items A., B., C., D., and E. above)

2.0 SIGNATURES: By signing this Document, I agree that I have received and reviewed all Addenda and considered all costs associated with the Addenda in calculating the Total Bid Price.

Bidder: _____
(Print or type full name of your proprietorship, partnership, corporation, or joint venture.*)

**By: _____
Signature Date

Name: _____
(Print or type name) Title

Address: _____
(Mailing)

(Street, if different)

Telephone and Fax Number: _____
(Print or type numbers)

* If Bid is a joint venture, add additional Bid Form signature sheets for each member of the joint venture.

** Bidder certifies that the only person or parties interested in this offer as principals are those named above. Bidder has not directly or indirectly entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding.

Note: This document constitutes a government record, as defined by § 37.01 of the Texas Penal Code. Submission of a false government record is punishable as provided in § 37.10 of the Texas Penal Code.

Footnotes for Tables B through E:

- (1) Fixed Unit Price determined prior to Bid. Cannot be adjusted by the Bidder.
- (2) Minimum Bid Price determined prior to Bid. Can be increased by the Bidder by crossing out the Minimum and noting revised price on the line above.
- (3) Maximum Bid Price determined prior to Bid. Can be decreased but not increased by Bidder by crossing out the Maximum and noting revised price on the line above. A Bid that increases the Maximum Bid Price may be found non-conforming and non-responsive.
- (4) Fixed Range Bid Price determined prior to Bid. Unit Price can be adjusted by Bidder to any amount within the range defined by crossing out prices noted and noting revised price on the line above.

Document 00430

BIDDER'S BOND

THAT WE, _____, as Principal,
(Bidder)
("Bidder"), and the other subscriber hereto, _____, as Surety, do hereby
acknowledge ourselves to be held and firmly bound to the City of Houston, a municipal corporation, in the sum
of _____ Dollars (\$_____) (an amount
equal to 10 percent of the Total Bid Price, including Cash Allowances and Alternates, if any, for the payment of
which sum, well and truly to be made to the City of Houston and its successors, the Bidder and Surety do bind
themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Bidder has submitted on or about this day a proposal offering to perform the following:

(Project Name, Location and Number)
in accordance with the Drawings, Specifications, and terms and conditions related thereto to which reference is
hereby made.

NOW, THEREFORE, if the Bidder's offer as stated in the Document 00410 – Bid Form is accepted by the
City, and the Bidder executes and returns to the City Document 00520 – Agreement, required by the City, on
the forms prepared by the City, for the Work and also executes and returns the same number of the
Performance, Payment and Maintenance Bonds (such bonds to be executed by a Corporate Surety authorized
by the State Board of Insurance to conduct insurance business in the State of Texas, and having an
underwriting limitation in at least the amount of the bond) and other submittals as required by Document 00495
- Post-Bid Procedures, in connection with the Work, within the Contract Time, then this obligation shall become
null and void; otherwise it is to remain in full force and effect.

If Bidder is unable to or fails to perform the obligations undertaken herein, the undersigned Bidder and
Surety shall be liable to the City for the full amount of this obligation which is hereby acknowledged as the
amount of damages which will be suffered by the City on account of the failure of such Bidder to perform such
obligations, the actual amount of such damages being difficult to ascertain.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually
received or, if earlier, on the third day following deposit in a United States Postal Service post office or
receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective
other Party at the address prescribed in the Contract documents, or at such other address as the receiving
Party may hereafter prescribe by written notice to the sending Party.

IN WITNESS THEREOF, the Bidder and Surety have signed and sealed this instrument on the respective
dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

By: _____
Name:
Title:

ATTEST/SURETY WITNESS: (SEAL)

By: _____
Name:
Title:
Date:

(Name of Bidder)

By: _____
Name:
Title:
Date:

(Full Name of Surety)

(Address of Surety for Notice)

(Telephone Number of Surety)

By: _____
Name:
Title:
Date:

END OF DOCUMENT

Document 00450

BIDDER'S STATEMENT OF MWBE/PDBE/DBE/SBE STATUS

This certifies that the status of the Bidder, _____, in
(Bidder's Name)

regard to the City of Houston Code of Ordinances, Chapter 15, Article V, relating to City-wide percentage goals for contracting with Minority and Women-owned Business Enterprises (MWBE) and Disadvantaged Business Enterprises (DBE), Chapter 15, Article VI, relating to City-wide percentage goals for contracting with Persons with Disabilities Business Enterprises (PDBE) and Chapter 15, Article IX, relating to City-wide percentage goals for contracting with a Small Business Enterprise (SBE) is as follows:

1. Bidder (individual, partnership, corporation) is is not a Minority Business Enterprise as certified by the Office of Business Opportunity.
2. Bidder (individual, partnership, corporation) is is not a Women-owned Business Enterprise as certified by the Office of Business Opportunity
3. Bidder (individual, partnership, corporation) does does not declare itself to be a Persons with Disabilities Business Enterprise as defined above.
4. Bidder (individual, partnership, corporation) does does not declare itself to be a Disadvantaged Business Enterprise as defined above.
5. Bidder (individual, partnership, corporation) does does not declare itself to be a Small Business Enterprise as defined above.

Signature: _____

Title: _____

Date: _____

END OF DOCUMENT

Document 00452

Form A

CONTRACTOR SUBMISSION LIST
CITY OF HOUSTON FAIR CAMPAIGN ORDINANCE

The City of Houston Fair Campaign Ordinance makes it unlawful for a Contractor to offer any contribution to a candidate for City elective office (including elected officers-elect) during a certain period of time prior to and following the award of the Contract by the City Council. The term "Contractor" includes proprietors of proprietorships, partners or joint venturers having an equity interest of 10 percent or more for the partnership or joint venture, and officers, directors and holders of 10 percent or more of the outstanding shares of corporations. Submission of a statement disclosing the names and business addresses of each of those persons is required with each Bid/Proposal for a City Contract. See Chapter 18 of the City of Houston Code of Ordinances for further information.

This list is submitted under the provisions of Section 18-36(b) of the City of Houston Code of Ordinances in connection with the attached Bid/Proposal of:

Firm or Company Name: _____

Firm or Company Address: _____

The firm/company is organized as indicated below. Check one as applicable and attach additional pages if needed to supply the required names and addresses.

SOLE PROPRIETOR

Name _____
Proprietor Address _____

A PARTNERSHIP

LIST EACH PARTNER HAVING EQUITY INTEREST OF 10% OR MORE OF PARTNERSHIP (IF NONE STATE "NONE")

Name _____
Partner Address _____

Name _____
Partner Address _____

A CORPORATION

LIST ALL DIRECTORS OF THE CORPORATION (IF NONE STATE "NONE")

Name _____
Director Address _____

Name _____
Director Address

Name _____
Director Address

LIST ALL OFFICERS OF THE CORPORATION (IF NONE STATE "NONE")

Name _____
Officer Address

Name _____
Officer Address

Name _____
Officer Address

LIST ALL INDIVIDUALS OWNING 10% OR MORE OF OUTSTANDING
SHARES OF STOCK OF THE CORPORATION (IF NONE STATE "NONE")

Name _____
Owner Address

Name _____
Owner Address

Name _____
Owner Address

I certify that I am duly authorized to submit this list on behalf of the firm, that I am associated with the firm in the capacity noted below, and that I have knowledge of the accuracy of the information provided herein.

Signature

Printed Name

Title

Note: This list constitutes a government record as defined by § 37.01 of the Texas Penal Code.

END OF DOCUMENT

Document 00453

BIDDER'S STATEMENT OF RESIDENCY

The City may not award a contract for general construction, services, or purchases to a Nonresident Bidder unless Nonresident's Bid is lower than the lowest Bid submitted by a responsible Texas Resident Bidder by the same amount that a Texas Resident bidder would be required to underbid the Nonresident Bidder to obtain a comparable contract in the state in which Nonresident's principle place of business is located.

1. This certifies that the Bidder, _____, is a State of Texas Resident Bidder as defined in TEX. GOVT. CODE ANN. § 2252.001(4) (Vernon 1994).

Signature

Title

"Texas Resident Bidder" means a bidder whose principal place of business is in this State, and includes a Contractor whose ultimate parent company or majority owner has its principal place of business in this State. *When bidder cannot sign 1, above, proceed to 2.*

2. a. _____ is a resident of _____ and is a Nonresident Bidder as defined in TEX. GOVT. CODE ANN. § 2252.001(3) (Vernon 1994).

Signature

Title

"Nonresident Bidder" means a bidder whose principal place of business is not in this State, but excludes a contractor whose ultimate parent company or majority owner has its principal place of business in this State.

- b. The State of _____ Bidder's resident state _____ Does or Does Not have a state statute giving preference to resident bidders.

Signature

Title

If the answer to 2.b is that your state does have a statute giving preference to resident bidders, then you must provide a copy and proceed to 3.

3. A copy of the State of _____ statute is attached.

Signature

Title

Date

END OF DOCUMENT

Document 00454

AFFIDAVIT OF NON-INTEREST

BEFORE ME, the undersigned authority, a Notary Public in and for the State of Texas, on this day personally appeared _____, who
Affiant

being by me duly sworn on his oath stated that he is _____, of
Title

_____,
Name of Firm

the firm named and referred to and in the foregoing; and that he knows of no officer, agent, or employee of the City of Houston being in any manner interested either directly or indirectly in such Contract.

Affiant's Signature

SWORN AND SUBSCRIBED before me on _____
Date

Notary Public in and for the State of TEXAS

Print or type name

My Commission Expires: _____
Expiration Date

END OF DOCUMENT

5. The information shown below is true and correct for the Contracting Entity and all owners of 5% or more of the Contracting Entity and, where the Contracting Entity is a non-profit entity, the required information has been shown for each officer, *i.e.*, president, vice-president, secretary, treasurer, etc. **[NOTE: IN ALL CASES, USE FULL NAMES, LOCAL BUSINESS AND RESIDENCE ADDRESSES AND TELEPHONE NUMBERS. DO NOT USE POST OFFICE BOXES FOR ANY ADDRESS. INCLUSION OF E-MAIL ADDRESSES IS OPTIONAL, BUT RECOMMENDED. ATTACH ADDITIONAL SHEETS AS NEEDED.]**

Contracting Entity

Name: _____
Business Address **[No./STREET]** _____
[CITY/STATE/ZIP CODE] _____
Telephone Number (____) _____
Email Address **[OPTIONAL]** _____
Residence Address **[No./STREET]** _____
[CITY/STATE/ZIP CODE] _____
Telephone Number (____) _____
Email Address **[OPTIONAL]** _____

5% Owner(s) or More (IF NONE, STATE "NONE.")

Name: _____
Business Address **[No./STREET]** _____
[CITY/STATE/ZIP CODE] _____
Telephone Number (____) _____
Email Address **[OPTIONAL]** _____
Residence Address **[No./STREET]** _____
[CITY/STATE/ZIP CODE] _____
Telephone Number (____) _____
Email Address **[OPTIONAL]** _____

6. Optional Information

Contracting Entity and/or _____ [NAME OF OWNER OR NON-PROFIT OFFICER] is actively protesting, challenging or appealing the accuracy and/or amount of taxes levied against _____ [CONTRACTING ENTITY, OWNER OR NON-PROFIT OFFICER] as follows:

Name of Debtor: _____

Tax Account Nos. _____

Case or File Nos. _____

Attorney/Agent Name _____

Attorney/Agent Phone No. (____) _____

Tax Years _____

Status of Appeal [DESCRIBE] _____

Affiant certifies that he or she is duly authorized to submit the above information on behalf of the Contracting Entity, that Affiant is associated with the Contracting Entity in the capacity noted above and has personal knowledge of the accuracy of the information provided herein, and that the information provided herein is true and correct to the best of Affiant's knowledge and belief.

Affiant

SWORN TO AND SUBSCRIBED before me this _____ day of _____, 20____.

(Seal)

Notary Public

NOTE:

This affidavit constitutes a **government record** as defined by Section 37.01 of the Texas Penal Code. Submission of a false government record is punishable as provided in Section 37.10 of the Texas Penal Code. Attach additional pages if needed to supply the required names and addresses.

Document 00457

Conflict of Interest Questionnaire

Print out latest version of CIQ form from website listed below:

Local Government Code Chapter 176 requires Bidders with the City of Houston ("City") to file a Conflict of Interest Questionnaire with the City Secretary of the City of Houston.

The Conflict of Interest Questionnaire is available for downloading on the Texas Ethics Commission's website at: <http://www.ethics.state.tx.us/forms/CIQ.pdf>. The completed Conflict of Interest Questionnaire will be posted on the City Secretary's website. Also you will find a list of the City Local Government Officers on the City Secretary's website.

For your convenience the CIQ form is attached as part of this document. Although the City has provided this document for the Bidders convenience, it is the Bidders responsibility to submit the latest version of the CIQ form as promulgated by the Texas Ethics Commission.

The Failure of any Bidder to comply with this law is a Class C misdemeanor.

END OF DOCUMENT

Document 00459

CONTRACTOR'S STATEMENT REGARDING PREVIOUS CONTRACTS
SUBJECT TO EQUAL EMPLOYMENT OPPORTUNITY

Section 60-1.7(b) of the Regulations of the Secretary of Labor requires each bidder or prospective prime contractor and proposed subcontractor, where appropriate, to state in the bid or at the outset of negotiations for the contract whether it has participated in any previous contract or subcontract subject to the equal opportunity clause; and if so, whether it has filed with the Joint Reporting Committee, the Director, an agency, or the former President's Committee on Equal Employment Opportunity all reports due under the applicable filing requirements. In any case in which a bidder or prospective prime contractor or proposed subcontractor which participated in a previous contract subject to Executive Order 10925, 11114, or 11246 has not filed a report due under the applicable filing documents, no contract or subcontract shall be awarded unless such contractor submits a report covering the delinquent period or such other period specified by the FAA or the Director, OFCCP.

Contractor has ___ has not ___ participated in a previous contract subject to the equal opportunity clause prescribed by Executive Order 10925, or Executive Order 11114, or Executive Order 11246.

Contractor has ___ has not ___ submitted all compliance reports in connection with any such contract due under the applicable filing requirements; and that representations indicating submission of required compliance reports signed by proposed subcontractors will be obtained prior to award of subcontracts.

If Contractor has participated in a previous contract subject to the equal opportunity clause and has not submitted compliance reports due under applicable filing requirements, Contractor (Proposer) shall submit a compliance report on Standard Form 100, "Employee Information Report EEO-1" prior to the award of the Contract.

Standard Form 100 is normally furnished to contractors annually, based on a mailing list currently maintained by the Joint Reporting Committee. In the event Contractor has not received the form, Contractor may obtain it by writing to the following address:

*Joint Reporting Committee
1800 G Street
Washington, DC 20506*

(Printed or typed Name of Signatory)

Signature

Date

Title

Contractor's Firm Name

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

END OF DOCUMENT

00459-1
02-01-2004

Document 00460
(POP -1)
City of Houston
Pay or Play Program
Acknowledgement Form

It has been determined that the project currently open for bidding meets the criteria of the City of Houston Pay or Play program. This form acknowledges your awareness of the Pay or Play program which is authorized by Ordinance 2007-534. Your signature below affirms that you will comply with the requirements of the program if you are the successful bidder/proposer, and ensure the same on behalf of subcontracts subject to the Pay or Play Program.

I declare under penalty of perjury under the laws of the State of Texas that if awarded this contract which meets the criteria for the City of Houston's Pay or Play Program, I will comply with all requirements of the Pay or Play Program in accordance with Executive Order 1-7.

***Fill out all information below and submit this form with your bid/proposal packet.**

Solicitation Number

Signature

Date

Print Name

City Vendor ID

Company Name

Phone Number

Email Address

Note: For more information contact your POP Liaison or the POP Contract Administrator. All contact information can be found on www.houstontx.gov →Departments→Office of Business Opportunity→Pay or Play.

Document 00470

BIDDER'S MWSBE PARTICIPATION PLAN

The Bidder or Proposer shall submit this completed form with the bid, to demonstrate the Bidder/Proposer's plan to meet the contract-specific MWSBE goal ("contract goal"). If the Bidder or Proposer cannot meet the contract goal, the Bidder/Proposer has the burden to demonstrate "Good Faith Efforts", which shall include correctly and accurately preparing and submitting this form, a Record of Good Faith Efforts (Document 00471), and a Request for Deviation from the Goal (Document 00472), the documentation evidencing their "Good Faith Efforts", as required by the City of Houston's Good Faith Efforts Policy (Document 00808). The City will review the Participation Plan and Good Faith Efforts at the time of bid opening. Visit <http://www.houstontx.gov/obo> for more information.

Contract Goal	MBEGoal % <u>10.4%</u>	WBEGoal % <u>3%</u>	Bidder's Participation Plan Percentage	SBE	MBE	WBE	Total
----------------------	----------------------------------	-------------------------------	---	------------	------------	------------	--------------

NAICS Code (6 digit)	Description of Work (Plan Sheet #, Unit Price #, Scope of Work #, as applicable)	% of Total Bid Price (2 decimal places)	Cert. Type for Goal MBE, WBE, SBE)	Certified Firm Name Firm Address Contact Name Phone No. and E-Mail (if available)

Signature for Company: _____ Date: _____
Print Name: _____ Phone: _____
Bidder: _____

(Print or type full name of business entity, such as corporation, LLC, etc)

I understand that supplying inaccurate information may violate Texas Penal Code Section 37.10 and lead to City sanctions.

Document 00471

PRE-BID GOOD FAITH EFFORTS

Bidder or Proposer Name: _____ **Project Name** _____

A Bidder or Proposer that may be unable to complete or follow a Participation Plan (Document CCD-00470) to meet the Contract Goal in the Supplemental Conditions (Document 00800), must submit this completed form as well as a Goal Deviation Request Form (Document 00472), and any other documentation of "Good Faith Efforts" with the bid (see Document 00808). The Bidder or Prime Contractor has the burden to demonstrate "Good Faith Efforts" to meet the MWSBE goal, which includes correctly and accurately preparing and submitting this form and other efforts described in the City's Good Faith Efforts Policy (Document 00808). The Office of Business Opportunity will review Good Faith Efforts and Participation Plan after selection of an apparent low bidder.

UNLESS THE BIDDER'S/PROPOSER'S PARTICIPATION PLAN MEETS THE CONTRACT GOAL, FAILURE TO SUBMIT THIS FORM MAY RESULT IN THE BID BEING FOUND NON-RESPONSIVE.

NAICS Code	Plan Item No.	MWSBE Type for Goal	Certified Firm Name Address, Phone No. and E-Mail	Certified Firm Contact Person	Method of Contact	Prime Contact Date	Certified Firm Response	Results of Contact (why suitable or not suitable for work)
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			

Authorized Signature: _____

Date: _____

Phone: _____

Print Name: _____

Email Address: _____

CONTINUATION PAGE

NAICS Code	Plan Item No.	MWSBE Type for Goal	Certified Firm Name Address, Phone No. and E-Mail	Certified Firm Contact Person	Method of Contact	Prime Contact Date	Certified Firm Response	Results of Contact (why suitable or not suitable for work)
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			

Authorized Signature: _____

Date: _____

Phone: _____

Print Name: _____

Email Address: _____

Document 00472

BIDDER'S MWSBE GOAL DEVIATION REQUEST

Bidder or Proposer Name: _____

Project Name & Bid/Contract #: _____

Department Approved MWSBE Goals	MBE	WBE	SBE	Total
	%	%	%	%

Bidder's Proposed MWSBE Goals	MBE	WBE	SBE	Total
	%	%	%	%

Justification: Please provide the reason the Bidder is unable to meet the Contract Goal in Form 00800.

Good Faith Efforts: Please list any efforts not listed in the Bidder's Good Faith Effort Report (Form 00471).

Date: _____ Bidder: _____

Email: _____ By: _____

Phone Number: _____ Title: _____

FOR OFFICIAL USE ONLY: Approved <input type="checkbox"/>	Not Approved <input type="checkbox"/>
OBO Representative _____	Date: _____ Title: _____

Document 00495

POST-BID PROCEDURES

1.0 DOCUMENT ADDRESSES

- A. Notice of Intent to Award
- B. Monitoring Authority/Contracting Department
- C. Requirements of Bidder
- D. Failure of Bidder to comply with requirements
- E. Notice to Proceed

2.0 NOTICE OF INTENT TO AWARD

- A. The City will provide written Notice of Intent to Award to Low Bidder.

3.0 DEFINITIONS

- A. The "Monitoring Authority" or "OBO" for this Project is:

Director, Office of Business Opportunity Division
City of Houston
611 Walker Street, 7th Floor
Houston, Texas 77002

- B. The "Contracting Department" for this Project is:

Director, Department of DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
City of Houston
611 Walker Street
Houston, Texas 77002
ATTN: **Akhter Hussain, P.E.,**

4.0 REQUIREMENTS OF BIDDER

- A. Within 10 days of receipt of Notice of Intent to Award, Low Bidder shall execute and deliver to Akhter Hussain, P.E., Project Manager and Monitoring Authority, for the City's approval, documents indicated by an "X" below:

[] Document 00570 – Revised MWSBE Participation Plan *(Do not submit if OBO*

Director approved Bidder's Plan – Document 00470)

- Executed Subcontract(s), Letter(s) of Intent, or documentation of good faith efforts to meet the MWSBE goals
- B. Within 10 days of receipt of Notice of Intent to Award, Low Bidder shall execute and deliver to Akhter Hussain, P.E., Project Manager for the City's approval, documents indicated by an "X" below:
- Document 00500 - Form of Business
 - Document 00501 - Resolution of Contractor
 - Document 00520 - Agreement
 - Document 00600 - List of Proposed Subcontractors and Suppliers
 - Document 00601 - Drug Policy Compliance Agreement
 - Document 00602 - Contractor's Drug-free Workplace Policy (*Contractor creates this document.*)
 - Document 00604 - History of OSHA Actions and List of On-the-job Injuries
 - Document 00605 - List of Safety Impact Positions (*Contractor completes this list. Do not submit if submitting Document 00606.*)
 - Document 00606 - Contractor's Certification of No Safety Impact Positions (*Do not submit if submitting Document 00605.*)
 - Document 00607 - Certification Regarding Debarment, Suspension, and Other Responsibility Matters
 - Document 00608 - Contractor's Certification Regarding Non-segregated Facilities for Project Funded by AIP Grant
 - Document 00610 - Performance Bond
 - Document 00611 - Statutory Payment Bond
 - Document 00612 - One-year Maintenance Bond
 - Document 00613 - One-year Surface Correction Bond
 - Document 00620 - Affidavit of Insurance (*with Certificate of Insurance attached*)
 - Document 00622 - Name and Qualifications of Proposed Superintendent (*Contractor creates this document.*)
 - Document 00623 - Contractor's Act of Assurance (SRF Form ED-103)
 - Document 00624 - Affidavit of Compliance with S/WMBE Program
 - Document 00625 - SRF Participation Summary
 - Document 00626 - SRF Affirmative Steps Solicitation Report
 - Document 00627 - SRF Prime Contractor Affirmative Steps Certification and Goals
 - Document 00629 - Affidavit for FAA Form 7460-1
 - Document 00630 - Certification of Compliance with Pay or Play Program
 - Document 00631 - City of Houston Pay or Play Program – List of Subcontractors
 - Document 00809 – CDBG Requirements for Federally Funded Projects
- C. Within 10 days of receipt of Notice of Intent to Award, Low Bidder shall execute the following forms and deliver them directly to the Monitoring Authority.
1. Original forms contained in Document 00805 – Equal Employment Opportunity Program Requirements:
 - Pages 00805-3 to 00805-5, Certification by Bidder Regarding Equal

- Employment Opportunity*
- Page 00805-6, Total Work Force Composition of the Company, or copy of latest EEO-1 form (required only if Contractor has a work force of 50 or more people and the Original Contract Price is \$50,000 or more)*
 - Page 00805-7, Equal Employment Opportunity Compliance Program*
 - Page 00805-26, Certification by Proposed Subcontractor Regarding Equal Employment Opportunity*
 - Page 00805-29, Certification by Proposed Material Supplier, Lessor, and Professional Service Providers Regarding Equal Employment Opportunity*
2. Original completed form Document 00633 - Certification by Proposed Material Suppliers, Lessors, and Professional Service Providers Regarding Equal Employment Opportunity, for each proposed material supplier and equipment supplier.
3. Original forms contained in Document 00820 – Wage Scale for Engineering Construction.
- Certificate from Contractor Appointing Officer or Employee to Supervise Payment of Employees*
 - Certificate from SubContractor Appointing Officer or Employee to Supervise Payment of Employees*
 - Document 00812, Exhibit “A” – Certificate from Contractor Appointing Officer or Employee to Supervise Payment of Employees
- D. Designations of Subcontractors and Suppliers, who have been selected by Bidder in Document 00600 - List of Proposed Subcontractors and Suppliers, and accepted by the City, may be changed only with prior notice and acceptance by Project Manager as provided in Conditions of the Contract. For each Product Supplier subsequently added or substituted, provide an original completed form, Document 00633 - Certification by Proposed Material Suppliers, Lessors, and Professional Service Providers Regarding Equal Employment Opportunity, directly to the Monitoring Authority.
- E. On Bidder's written request, Akhter Hussain, P.E., Project Manager may grant an extension of time, not to exceed 5 days, to furnish documents specified in Paragraphs 4.0.A and 4.0.B. If Bidder is required to resubmit documents specified in Paragraph 4.0.A or 4.0.B, Bidder shall do so within time limits provided in the request for resubmission.
- F. Designations of Subcontractors and Suppliers, who have been selected by Bidder in its Participation Plan, and accepted by the City, may be changed only with prior notice and acceptance by the Monitoring Authority as provided in Document 00808 – Bidder/Contractor Requirements for the City of Houston Minority, Women, and Small Business Enterprise (MWSBE), and Persons with Disabilities Business Enterprise (PDBE).
- 5.0 FAILURE OF BIDDER TO COMPLY WITH REQUIREMENTS
- A. Should Bidder, on receipt of Notice of Intent to Award, fail to comply with requirements of this Document 00495 within stated time, the City may declare award in default and require forfeiture of the Security Deposit.

- B. After the City's written notice of default to Low Bidder, the City may award the Contract to Bidder whose offer is the next lowest bid, and Security Deposit of Bidder in default shall be forfeited to the City in accordance with provisions of Document 00200 - Instructions to Bidders.

6.0 NOTICE TO PROCEED

- A. Upon the City's execution of the Agreement and delivery to Contractor, City Engineer will give Document 00551 - Notice to Proceed to Contractor, which establishes Date of Commencement of the Work.

END OF DOCUMENT

Document 00500

FORM OF BUSINESS

Please mark the box describing your firm's form of business, fill in the requested information, and include the relevant attachments.

Corporation

Corporate Name: _____
State of Incorporation: _____
Mailing Address: _____
Type of Corporation: _____

Certificate of Assumed Name, if operating under a name different than that on the corporate charter (the Certificate must have been issued within the past 10 years to be valid)

*Certificate of Good Standing

*Certificate of Existence (if non-Texas corporation, Certificate of Authority)

Partnership/Joint Venture

Partnership/Joint Venture Name: _____
Mailing Address: _____
Type of Partnership/Joint Venture: _____

Copy of the Partnership or Joint Venture Agreement, **or**
Affidavit with the name of the partnership or joint venture, the names of the individual partners or participants in the joint venture, and a statement that the partnership or joint venture is in existence

Certificate of Assumed Name, (the Certificate must have been issued within the past 10 years to be valid)

If firm is a limited partnership, the Certificate of Limited Partnership

If any partner or joint venturer is a corporation, the above information relating to corporation must be included as to each sum partner or joint venturer.

Sole Proprietorship

Name: _____
Mailing Address: _____

Certificate of Assumed Name, if operating under a name different than that of the sole proprietor (the Certificate must have been issued within the past 10 years to be valid)

* Must be furnished upon request of the Director and must be less than 90 days old.

END OF DOCUMENT

Document 00501

RESOLUTION OF CONTRACTOR

_____ (“Contractor”),
(Name of Contractor, e.g., “Biz. Inc.”, “Biz LLP”)
is a _____,
(Type of Organization, e.g.: Corporation, Limited Partnership, Limited Liability Partnership, Limited Liability Company, etc.)
which is bound by acts of _____,
(Name and Form of Governing Entity, e.g., “Biz Inc. Board of Directors”, “Bill Smith, GP”, etc.)
 (“Governing Entity”).

On the ____ day of _____, 20____, the Governing Entity resolved, in accordance with all documents, rules, and laws applicable to the Contractor, that _____, is authorized to act as the
(Contractor’s Representative)
Contractor’s Representative in all business transactions (initial one) ____ conducted in the State of Texas OR ____ related to this Contract; and

The Governing Entity warrants that the above resolution (a) was entered into without dissent or reservation by the Governing Entity, (b) has not been rescinded or amended, and (c) is now in full force and effect; and

In authentication of the adoption of this resolution, I subscribe my name on this day of _____, 20____.

(Authorized Signature for Governing Entity)

(Print or Type Name and Title of Authorized Signatory)

SWORN AND SUBSCRIBED before me on _____
Date

Notary Public in and for the State of Texas

My Commission Expires: _____
Expiration Date

Print or Type Name of Notary Public

Document 00520

AGREEMENT

Project: 11th Street Odor Control Facility Improvements

Project Location: 2100 W 11th Street, Houston, Texas 77008(Key Map No. 452Y)

Project No: WBS No. R-000020-0010-4

The City: THE CITY OF HOUSTON, 900 Bagby Street, Houston, Texas 77002 (the "City")
and

Contractor: _____

(Address for Written Notice) _____

Fax Number: _____ **Phone Number:** _____

City Engineer, with respect to Sections 4.3 thru 4.5 of the General Conditions, is:

J. Timothy Lincoln, P.E. (or his successor)

P. O. Box 1562, Houston, Texas 77251-1562 (Address for Written Notice)

City Engineer, with respect to all other terms of the General Conditions, is:

Joseph T. Myers, P.E. (or his successor)

Fax Number: (832) 395-2410

THE CITY AND CONTRACTOR AGREE AS FOLLOWS:

**ARTICLE 1
THE WORK OF THE CONTRACT**

1.1 Contractor shall perform the Work in accordance with the Contract.

**ARTICLE 2
CONTRACT TIME**

2.1 Contractor shall achieve Date of Substantial Completion within **360** days after Date of Commencement of the Work, subject to adjustments of Contract Time as provided in the Contract.

2.2 The Parties recognize that time is of the essence for this Agreement and that the City will suffer financial loss if the Work is not completed within the Contract Time. Parties also recognize delays, expense, and difficulties involved in proving in a legal or arbitration proceeding actual loss suffered by the City if the Work is not completed on time. Accordingly, instead of requiring any such proof, the Parties agree that as

liquidated damages for delay (but not as a penalty), Contractor shall pay the City the amount stipulated in Document 00800 – Supplementary Conditions, for each day beyond Contract Time.

**ARTICLE 3
CONTRACT PRICE**

3.1 Subject to terms of the Contract, the City will pay Contractor in current funds for Contractor's performance of the Contract, Contract Price of \$ _____ which includes Alternates, if any, accepted below.

3.2 The City accepts Alternates as follows:

*Delete or add lines below to indicate all Alternates that were included in Request for competitive sealed proposals. Remove brackets and instructions when done.
Change color of remaining text to black.*

Alternate No. 1 [Accepted or Not Accepted]
Alternate No. 2 [Accepted or Not Accepted]
Alternate No. 3 [Accepted or Not Accepted]
Alternate No. 4 [Accepted or Not Accepted]

**ARTICLE 4
PAYMENTS**

4.1 The City will make progress payments to Contractor as provided below and in Conditions of the Contract.

4.2 The Period covered by each progress payment is one calendar month ending on the [] 15th or [] last day of the month.

4.3 The City will issue Certificates for Payment and will make progress payments on the basis of such Certificates as provided in Conditions of the Contract.

4.4 Final payment, constituting entire unpaid balance of Contract Price, will be made by the City to Contractor as provided in Conditions of the Contract.

**ARTICLE 5
CONTRACTOR REPRESENTATIONS**

5.1 Contractor represents:

5.1.1 Contractor has examined and carefully studied Contract documents and other related data identified in Request For or Competitive Sealed Proposals or Competitive Sealed Bids.

5.1.2 Contractor has visited the site and become familiar with and is satisfied as to general, local, and site conditions that may affect cost, progress, and performance of the Work.

5.1.3 Contractor is familiar with and is satisfied as to all federal, state, and local laws and regulations that may affect cost, progress, and performance of the Work.

5.1.4 Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) which have been identified in Contract documents and (2) reports and drawings of a hazardous environmental condition, if any, at the site which has been identified in Contract documents.

5.1.5 Contractor has obtained and carefully studied (or assumes responsibility for having done so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including applying specific means, methods, techniques, sequences, and procedures of construction, if any, expressly required by the Contract to be employed by Contractor, and safety precautions and programs incident thereto

5.1.6 Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for performance of the Work at Contract Price, within Contract Time, and in accordance with the Contract.

5.1.7 Contractor is aware of general nature of work to be performed by the City and others at the site that relates to the Work as indicated in Contract documents.

5.1.8 Contractor has correlated information known to Contractor, information and observations obtained from visits to the site, reports and drawings identified in the Contract, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract.

5.1.9 Contractor has given City Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract, and written resolution thereof by City Engineer is acceptable to Contractor.

5.1.10 Contract documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 6 MISCELLANEOUS PROVISIONS

6.1 The Contract may be terminated by either Party as provided in Conditions of the Contract.

6.2 The Work may be suspended by the City as provided in Conditions of the Contract.

ARTICLE 7 ENUMERATION OF CONTRACT DOCUMENTS

7.1 The following documents are incorporated into this Agreement:

7.1.1 Document 00700 - General Conditions.

7.1.2 Document 00800 - Supplementary Conditions.

7.1.3 Division 01 - General Requirements.

7.1.4 Divisions 02 through 16 of Specifications.

7.1.5 Drawings listed in Document 00015 - List of Drawings. Drawing No. _____ and bound separately.

7.1.6 Addenda [and Riders] which apply to the Contract, are as follows:

Addendum No. 1, dated	<u>None</u>
Addendum No. 2, dated	<u>None</u>
Addendum No. 3, dated	<u>None</u>
Rider No. [], dated	<u>None</u>

7.1.7 Other documents:

<u>Document No.</u>	<u>Title</u>
[X] 00410B	Bid Form – Part B
[X] 00470	Standard Pre-Bid Participation Plan Document
[] 00471	Pre-Bid Good Faith Efforts Report
[] 00472	Goal Deviation Request
[] 00500	Form of Business
[X] 00501	Resolution of Contractor (if a corporation)
[] 00570	Amended S/MWBE Participation Plan
[] 00571	Contractor's Good Faith Efforts Report
[] 00572	Plan Deviation Request
[] 00608	Contractor's Certification Regarding Non-Segregated Facilities for Project Funded by AIP Grant
[X] 00610	Performance Bond
[X] 00611	Statutory Payment Bond
[X] 00612	One-year Maintenance Bond
[] 00613	One-year Surface Correction Bond
[X] 00620	Affidavit of Insurance (with the Certificate of Insurance attached)
[] 00623	Contractor's Act of Assurance (SRF Form ED-103)
[X] 00624	Affidavit of Compliance with Affirmative Action Program
[] 00628	Affidavit of Compliance with Disadvantaged Business Enterprise (DBE) Program for Project Funded By AIP Grant
[X] 00630	(POP-2) Certification of Compliance with Pay or Play Program
[X] 00631	(POP-3) City of Houston Pay or Play Program – List of Subcontractors
[X] 00800	Supplementary Conditions for Project CIP or AIP Funded
[] 00801	Supplementary Conditions for Project AIP Funded
[] 00802	SRF Supplementary Conditions
[X] 00805	Equal Employment Opportunity Program Requirements
[] 00806	EPA DBE and Wage Rate Requirements (SRF only)
[] 00807	Bidder/Contractor Requirements for DBE Program
[X] 00808	Minority and Women-owned Business Enterprise (MWBE) & Persons with Disabilities Business Enterprise (PDBE) Program
[] 00810	Federal Wage Rate - Highway
[] 00811	Federal Wage Rate - Building
[] 00812	Federal Wage Rate - Heavy
[X] 00820	Wage Rate for Engineering Construction
[] 00821	Wage Rate for Building Construction
[X] 00830	Trench Safety Geotechnical Information
[X] 00840	Pay or Play Program
[] 00912	Rider

**ARTICLE 8
SIGNATURES**

8.1 This Agreement is executed in two original copies and is effective as of the date of countersignature by City Controller.

CONTRACTOR:

(If Joint Venture)

By: _____
Name: _____
Title: _____
Date: _____
Tax Identification Number: _____

By: _____
Name: _____
Title: _____
Date: _____
Tax Identification Number: _____

CITY OF HOUSTON, TEXAS

APPROVED:

SIGNED:

By: _____
Director,
Department of Public Works and Engineering

By: _____
Mayor

COUNTERSIGNED:

By: _____
City Controller

Date Countersigned:

ATTEST/SEAL:

By: _____
City Secretary

8.2 This Contract and Ordinance have been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. Legal Department has not reviewed the content of these documents.

Legal Assistant

Date

END OF DOCUMENT

Document 00570

CONTRACTOR'S REVISED MWSBE PARTICIPATION PLAN

As soon as the Contractor becomes aware that the Contractor may not abide by the most current approved Plan, the Contractor shall submit this completed form with a Record of Post-Bid Good Faith Efforts (Document 00571), a Request for Plan Deviation (Document 00572), and any other document evidencing "Good Faith Efforts", as required by the Good Faith Efforts Policy (Document 00808). The City will review this Revised Participation Plan and may approve this Revised Plan if the Contractor has made Good Faith Efforts. For more information, visit <http://www.houstontx.gov/obo>.

Original Participation Plan Percentage	MBE	WBE	SBE	Revised Participation Plan Percentage	MBE	WBE	SBE
---	-----	-----	-----	--	-----	-----	-----

NAICS Code (6 digit)	Description of Work (Plan Sheet #, Unit Price #, Scope of Work #, as applicable)	% of Total Bid Price (2 decimal places)	Cert. Type for Goal (MBE, WBE, SBE)	Certified Firm Name Firm Address Contact Name Phone No. and E-Mail (if available)

Signature for Company: _____ * Date: _____
Print Name: _____ Phone: _____

*I understand that supplying inaccurate information may violate Texas Penal Code Section 37.10 and lead to City sanctions.

Document 00571

RECORD OF POST-AWARD GOOD FAITH EFFORTS

Contractor Name: _____ **Project Name:** _____

A Contractor that may be unable to follow an agreed Participation Plan (Document 00470 or 00570) must submit this completed form, a Plan Deviation Request Form (Document 00572), and any other documentation of "Good Faith Efforts" (see Document 00808) that the OBO Representative may require. The Contractor shall submit one completed Document 00571 (Part A) for each Certified Firm that is no longer performing part or all of its work duties under the Approved Plan. The Contractor has the burden to demonstrate "Good Faith Efforts" to meet the MWSBE goal, which includes correctly and accurately preparing and submitting this form and other efforts described in the Good Faith Efforts Policy (Document 00808). The Office of Business Opportunity may review Participation Plan and Good Faith Efforts from time to time and may request that the Contractor submit this form and other information.

UNLESS THE CONTRACTOR MEETS THE GOALS IN THE AGREED PARTICIPATION PLAN, FAILURE TO SUBMIT THIS FORM MAY RESULT IN A DEFAULT OF THE CONTRACT.

PART A (REASON FOR NON-USE OF CERTIFIED FIRM IN AGREED PLAN)

NAICS Code	Plan Item No.	MWSBE Type for Goal	Certified Firm Name, Address, Phone No. and E-mail	Plan Goal & Actual Use (in % of total)	Method of Contact	Reason for Non-Use (why the Contractor was not able to use the Certified Firm in accordance with the Agreed Plan)
				Plan %: _____ Actual %: _____	Phone € E-mail € Fax €	

PART B (REASON FOR NONUSE OF REPLACEMENT CERTIFIED FIRMS—IF APPLICABLE)

NAICS Code	Plan Item No.	MWSBE Type for Goal	Certified Firm Name Address, Phone No. and E-Mail	Certified Firm Contact Person	Method of Contact	Prime Contact Date	Certified Firm Response	Results of Contact (why Certified Firm was unsuitable or unusable)
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			

Authorized Signature: _____ Date: _____ Phone: _____

Print Name: _____ Email Address: _____

Document 00571

PART B CONTINUATION (REASON FOR NONUSE OF REPLACEMENT CERTIFIED FIRMS)

NAICS Code	Plan Item No.	MWSBE Type for Goal	Certified Firm Name Address, Phone No. and E-Mail	Certified Firm Contact Person	Method of Contact	Prime Contact Date	Certified Firm Response	Results of Contact (why Certified Firm was unsuitable or unusable)
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			
					Phone € E-mail € Fax €			

Authorized Signature: _____

Date: _____

Phone: _____

Print Name: _____

Email Address: _____

Document 00572

CONTRACTOR'S REQUEST FOR PLAN DEVIATION

Contractor Name: _____

Project Name: _____

Approved Participation Plan Percentages	MBE	WBE	SBE	Total
	%	%	%	%

Contractor's Requested Participation Plan	MBE	WBE	SBE	Total
	%	%	%	%

Justification: Please provide the reason the Contractor is unable to meet the MWSBE goal in the Approved Plan.

Good Faith Efforts: Please list any efforts not listed in Contractor's Record of Good Faith Effort (Document 00571).

Please attach additional pages if the space for Justification or Good Faith Efforts is insufficient.

Date: _____ *Contractor: _____

E-mail: _____ *By: _____

Phone Number: _____ Title: _____

*I understand that the approval of this deviation request does not constitute a final decision by OBO that Contractor has used Good Faith Efforts in meeting the Contracting Goal.

FOR OFFICIAL USE ONLY: Approved <input type="checkbox"/>	Not Approved <input type="checkbox"/>
OBO Representative _____	Date: _____
	Title: _____

00572-1

Document 00601

DRUG POLICY COMPLIANCE AGREEMENT

I, _____,
Name Title

of _____
Contractor

have authority to bind Contractor with respect to its Bid, Proposal, or performance of any and all contracts it may enter into with the City of Houston; and that by making this Agreement, I affirm that Contractor is aware of and by the time the Contract is awarded will be bound by and agree to designate appropriate safety impact positions for company employee positions, and to comply with the following requirements before the City issues a Notice to Proceed:

1. Develop and implement a written Drug Free Workplace Policy and related drug testing procedures for Contractor that meet the criteria and requirements established by the Mayor's Amended Policy on Drug Detection and Deterrence (Mayor's Drug Policy) and the Mayor's Drug Detection and Deterrence Procedures for Contractors (Executive Order No. 1-31).
2. Obtain a facility to collect urine samples consistent with Health and Human Services (HHS) guidelines and an HHS-certified drug-testing laboratory to perform drug tests.
3. Monitor and keep records of drug tests given and results; and upon request from the City of Houston, provide confirmation of such testing and results.
4. Submit semi-annual Drug Policy Compliance Declarations.

I affirm on behalf of Contractor that full compliance with the Mayor's Drug Policy and Executive Order No. 1-31 is a material condition of the Contract with the City of Houston,

I further acknowledge that falsification, failure to comply with or failure to timely submit declarations or documentation in compliance with the Mayor's Drug Policy or Executive Order No. 1-31 will be considered a breach of the Contract with the City and may result in non-award or termination of the Contract by the City.

Contractor Title

Signature Date

END OF DOCUMENT

Document 00604

HISTORY OF OSHA ACTIONS AND LIST OF ON-THE-JOB INJURIES

Prior to award of the Contract, Low Bidder will be required to file the following with the City:

1. A history of all OSHA actions, advisories, etc., Contractor has received on all jobs worked in any capacity, prime or subcontractor. The history shall be for the two-year period preceding the Bid Date of the Project.
2. A list of all on-the-job injuries, accidents, and fatalities suffered by any present or former employees of Contractor during the same two-year period.
3. If less than the two-year period, give the date Contractor started doing business.

This information must be submitted to the City within the time period stated in Document 00498 - Notice of Intent to Award. An officer of the company must certify in a notarized statement that the information submitted is true and correct.

END OF DOCUMENT

Document 00606

CONTRACTOR'S CERTIFICATION OF
NO SAFETY IMPACT POSITIONS IN PERFORMANCE OF A CITY CONTRACT

BEFORE ME, the undersigned authority, on this day personally appeared

_____ ,
Affiant

who being by me duly sworn on his oath stated that he is _____
Title

of _____
Contractor

and that no employee safety impact positions, as defined in §5.17 of Executive Order
No. 1-31, will be involved in performing _____
Project

Contractor agrees and covenants that it shall immediately notify the City of Houston
Director of Personnel if any safety impact positions are established to provide services
in performing this City Contract.

Affiant's Signature

SWORN AND SUBSCRIBED before me on this day of _____, 20__.

Notary Public in and for the State of TEXAS

Print or Type Notary Public Name

My Commission Expires: _____
Expiration Date

END OF DOCUMENT

Document 00607

CERTIFICATION REGARDING DEBARMENT,
SUSPENSION, AND OTHER RESPONSIBILITY MATTERS

Contractor certifies to the best of its knowledge and belief that it and its principals:

1. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal, State, or local department or agency;
2. Have not within a three-year period preceding this proposal 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, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
3. Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph 2 of this certification; and
4. Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award. In addition, under 18 USC Section 1001, a false statement may result in a fine of up to \$10,000 or imprisonment for up to five years, or both.

Company:

Typed Name & Title of Authorized Representative

Signature of Authorized Representative

Date

I am unable to certify the above statements. My explanation is attached.

END OF DOCUMENT

Document 00610

PERFORMANCE BOND

THAT WE, _____, as Principal, (the "Contractor"), and the other subscriber hereto, _____, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston (the "City"), a municipal corporation, in the penal sum of \$ _____ for the payment of which sum, well and truly to be made to the City, its successors and assigns, Contractor and Surety do bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a Contract in writing with the City for _____, all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein.

NOW THEREFORE, if the said Contractor shall faithfully and strictly perform the Contract in all its terms, provisions, and stipulations in accordance with its true meaning and effect, and in accordance with the Contract documents referred to therein and shall comply strictly with each and every provision of the Contract and with this Bond, then this obligation shall become null and void and shall have no further force and effect; otherwise the same is to remain in full force and effect. Should the Contractor fail to faithfully and strictly perform the Contract in all its terms, including but not limited to the indemnifications thereunder, the Surety shall be liable for all damages, losses, expenses and liabilities that the City may suffer in consequence thereof, as more fully set forth herein.

It is further understood and agreed that the Surety does hereby relieve the City or its representatives from the exercise of any diligence whatever in securing compliance on the part of the Contractor with the terms of the Contract, and the Surety agrees that it shall be bound to take notice of and shall be held to have knowledge of all acts or omissions of the Contractor in all matters pertaining to the Contract. The Surety understands and agrees that the provision in the Contract that the City will retain certain amounts due the Contractor until the expiration of 30 days from the acceptance of the Work is intended for the City's benefit, and the City will have the right to pay or withhold such retained amounts or any other amount owing under the Contract without changing or affecting the liability of the Surety hereon in any degree.

It is further expressly agreed by Surety that the City or its representatives are at liberty at any time, without notice to the Surety, to make any change in the Contract documents and in the Work to be done thereunder, as provided in the Contract, and in the terms and conditions thereof, or to make any change in, addition to, or deduction from the Work to be done thereunder; and that such changes, if made, shall not in any way vitiate the obligation in this Bond and undertaking or release the Surety therefrom.

It is further expressly agreed and understood that the Contractor and Surety will fully indemnify and save harmless the City from any liability, loss, cost, expense, or damage arising out of Contractor's performance of the Contract.

If the City gives Surety notice of Contractor's default, Surety shall, within 45 days, take one of the following actions:

1. Arrange for Contractor, with consent of the City, to perform and complete the Contract; or
2. Take over and assume completion of the Contract itself, through its agents or through independent contractors, and become entitled to the payment of the balance of the Contract Price.

If the Surety fails to take either of the actions set out above, it shall be deemed to have waived its right to perform and complete the Contract and receive payment of the balance of the Contract Price and the City shall be entitled to enforce any remedies available at law, including but not limited to completing the Contract itself and recovering any cost in excess of the Original Contract Price from the Surety.

This Bond and all obligations created hereunder shall be performable in Harris County, Texas. This Bond is given in compliance with the provisions of Chapter 2253, Texas Government Code, as amended, which is incorporated herein by this reference.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other Party at the address prescribed in the Contract documents, or at such other address as the receiving party may hereafter prescribe by written notice to the sending party.

IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

Name of Contractor

By: _____
Name:
Title:

By: _____
Name:
Title:
Date:

ATTEST/SURETY WITNESS:
(SEAL)

Full Name of Surety

Address of Surety for Notice

Telephone Number of Surety

By: _____
Name:
Title:
Date:

By: _____
Name:
Title: Attorney-in-Fact
Date:

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

Legal Assistant

Date

END OF DOCUMENT

Document 00611

STATUTORY PAYMENT BOND

THAT WE, _____, as Principal, hereinafter called Contractor and the other subscriber hereto, _____, as Surety, do hereby acknowledge ourselves to be held and firmly bound unto the City of Houston, a municipal corporation, in the sum of \$_____ for the payment of which sum, well and truly to be made to the City of Houston, and its successors, the said Contractor and Surety do bind themselves, their heirs, executors, administrators, successors, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a contract in writing with the City of Houston for _____, _____, all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein;

NOW, THEREFORE, if the said Contractor shall pay all claimants supplying labor and materials to him or a Subcontractor in the prosecution of the Work provided for in the Contract, then, this obligation shall be void; otherwise the same is to remain in full force and effect;

PROVIDED HOWEVER, that this Bond is executed pursuant to the provisions of Chapter 2253, Texas Government Code, as amended, and all liabilities on this Bond shall be determined in accordance with the provisions of said Article to the same extent as if it were copied at length herein.

IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

Name of Contractor

By: _____
Name:
Title:

By: _____
Name:
Title:
Date:

ATTEST/SURETY WITNESS:
(SEAL)

Full Name of Surety

Address of Surety for Notice

Telephone Number of Surety

By: _____
Name:
Title:
Date:

By: _____
Name:
Title: Attorney-in-Fact
Date:

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

Legal Assistant

Date

END OF DOCUMENT

Document 00612

ONE-YEAR MAINTENANCE BOND

THAT WE, _____, as Principal, hereinafter called Contractor, and the other subscriber hereto, _____, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston, a municipal corporation, in the sum of \$ _____, for the payment of which sum well and truly to be made to the City of Houston and its successors, the said Contractor and Surety do bind themselves, their heirs, executors, administrators, successors, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a Contract in writing with the City of Houston for _____, all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein.

NOW THEREFORE, if the said Contractor shall comply with the provisions of Paragraph 11.5.1 of the General Conditions, and correct work not in accordance with the Contract documents discovered within the established one-year period, then this obligation shall become null and void, and shall be of no further force and effect; otherwise, the same is to remain in full force and effect.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other party at the address prescribed in the Contract documents, or at such other address as the receiving party may hereafter prescribe by written notice to the sending party.

IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

Name of Contractor

By: _____
Name:
Title:

By: _____
Name:
Title:
Date:

ATTEST/SURETY WITNESS:
(SEAL)

Full Name of Surety

Address of Surety for Notice

Telephone Number of Surety

By: _____
Name:
Title:
Date:

By: _____
Name:
Title: Attorney-in-Fact
Date:

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

Legal Assistant

Date

END OF DOCUMENT

Document 00620

AFFIDAVIT OF INSURANCE

BEFORE ME, the undersigned authority, on this day personally appeared

_____, who
Affiant

being by me duly sworn on his oath stated that he is _____, of
Title

Contractor's Company Name

the Contractor named and referred to within the Contract documents; that he is fully competent and authorized to give this affidavit and that the attached original insurance certificate truly and accurately reflects the insurance coverage that is now available and will be available during the term of the Contract.

Affiant's Signature

SWORN AND SUBSCRIBED before me on _____.
Date

Notary Public in and for the State of TEXAS

Print or type Notary Public name

My Commission Expires: _____
Expiration Date

END OF DOCUMENT

Document 00624

**AFFIDAVIT OF COMPLIANCE WITH
AFFIRMATIVE ACTION PROGRAM**

BEFORE ME, the undersigned authority, on this day personally appeared

_____, who
Affiant
being by me duly sworn on his oath stated that he is _____,
Title
of _____,
Contractor

the Contractor named and referred to within the Contract documents; that he is fully competent and authorized to give this affidavit and that the Contract is in compliance with the Affirmative Action Program of the City and has done all that is required by the Contract documents, the Affirmative Action Program, and pursuant to Chapter 15, Code of Ordinances, City of Houston, §15.16 et seq.

Affiant's Signature

SWORN AND SUBSCRIBED before me on this day of _____, 20__.

Notary Public in and for the State of TEXAS

Print or Type Notary Public Name

My Commission Expires: _____
Expiration

END OF DOCUMENT

Document 00630
(POP-2)
City of Houston
Certification of Compliance with
Pay or Play Program

Contractor Name: _____ \$ _____
(Contractor/Subcontractor) (Amount of Contract)

Contractor Address: _____

Project No.: «WBSNo» _____

Project Name: «LegalPriName» _____

POP Liaison Name: _____

In accordance with the City of Houston Pay or Play Program authorized by Ordinance 2007-534 and Executive Order 1-7, Contractor/Subcontractor agrees to abide by the terms of this Program. This certification is required of all contractors for contracts subject to the program. You must agree EITHER to PAY or to PLAY for all covered employees. The Contractor/Subcontractor may also Pay on behalf of some covered employees and Play on behalf of other covered employees.

The Contractor/Subcontractor will comply with all provisions of the Pay or Play Program and will furnish all information and reports requested to determine compliance with program requirements of the Pay or Play Program (See Executive Order 1-7 for the terms of the Pay or Play program) The criteria of the program is as follows:

The Contractor/Subcontractor agrees to "Pay" \$1.00 per hour for work performed by covered employees under the contract with the City. If independent contract labor is utilized the Contractor/Subcontractor agrees to report hours worked by the independent contract laborer and pay \$1.00 per hour for work performed.

Otherwise the Contractor/Subcontractor agrees to "Play" by providing health benefits to each covered employee. The health benefits must meet the following criteria:

1. The employer will contribute no less than \$150 per employee per month toward the total premium cost for single coverage only; and
2. The employee contribution, if any amount, will be no greater than 50% of the total premium cost and no more than \$150 per month.
3. Pursuant to E.O. 1-7 section 4.04 a contractor is deemed to have complied with respect to a covered employee who is not provided health benefits if the employee refuses the benefits and the employee's contribution to the premium is no more than \$40 per month.

Please select whether you choose to:	Pay	Play	Both
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The Contractor/Subcontractor will file compliance reports with the City, which will include activity for covered employees subject to the program, in the form and to the extent requested by the administering department. Compliance reports shall contain information including, but not limited to, documentation showing employee health coverage and employee work records.

Note: The Contractor is responsible to the City for the compliance of covered employees of covered subcontractors and only forms that are accurate and complete will be accepted.

*Estimated Number of:	Prime Contractor	Sub-Contractor
Total Employees on City Job		
Covered Employees		
Non-Covered Employees		
Exempt Employees		

***Required**

I hereby certify that the above information is true and correct.

Contractor (Signature) _____ Date _____

Name and Title (Print or type) _____

**CITY OF HOUSTON
STANDARD DOCUMENT**

**EQUAL EMPLOYMENT OPPORTUNITY
CERTIFICATION BY MATERIAL SUPPLIERS**

Document 00633

**CERTIFICATION BY PROPOSED MATERIAL SUPPLIERS,
LESSORS, AND PROFESSIONAL SERVICE PROVIDERS
REGARDING EQUAL EMPLOYMENT OPPORTUNITY**

Company Name: _____ \$ _____
(Supplier, Lessor, Professional Service Provider) (Amount of Contract)

Company Address: _____

Company Telephone Number: _____ Fax: _____

E-mail Address: _____

Web Page/URL Address: _____

Company Tax Identification Number: _____

Project No.: [WBS/CIP/AIP/File No.]

Project Name: [Legal Project Name]

In accordance with the City of Houston Ordinance 78-1538, Supplier/Lessor/Professional Service Provider represents to be an equal opportunity employer and agrees to abide by the terms of the Ordinance. This certification is required of all Suppliers/Lessors/Professional Service Providers (herein Supplier) with contracts in the amount of \$10,000.00 or more.

- Yes No Supplier agrees not to discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, or age.
- Yes No Supplier agrees that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national origin, or age.
- Yes No Supplier will comply with all provisions of Executive Order No. 11246 and rules, regulations and applicable orders of the Department of Labor or other Federal Agency responsible for enforcement of applicable equal opportunity and affirmative action provisions and will likewise furnish all information and reports required by the Mayor or Contract Compliance Officers for the purpose of investigation to ascertain and effect compliance with the City of Houston's Office of Affirmative Action and Contract Compliance.
- Yes No The Supplier shall file and cause their sub-tier contractors to file compliance reports with the City in the form and to the extent as may be prescribed by the Mayor or Contract Compliance Officers. Compliance reports filed at such times as directed shall contain information including, but not limited to, the practices, policies, programs, and employment policies.

I hereby certify that the above information is true and correct.

COMPANY OFFICER (Signature)

DATE

NAME AND TITLE (Print or type)

END OF DOCUMENT

00633-1
02-01-2010

Instructions:

Before submitting this document, Contractor shall provide

1. *Payment Notifications (00646) to each subcontractor on each contract;*
2. *A copy to the City Monitoring Authority of all applicable Payment Notifications;*
3. *A list to the City Monitoring Authority containing the information requested in this document for each subcontractor from which Contractor has withheld payment;
and*
4. *The notarized signature of Contractor's Representative.*

Document 00642

MONTHLY SUBCONTRACTOR PAYMENT REPORTING FORM

Legal Project Name: _____

Outline Agreement No.: _____ WBS No.: _____

Contractor's Company Name: _____

Address: _____

CERTIFICATION

_____, Contractor's Representative for the above referenced Contract, hereby certifies that (1) Contractor has paid all subcontractors, except those noted below, (2) Contractor made such payments (a) in proportion to the amount City paid Contractor and (b) in accordance and compliance with all applicable Contract Documents and laws; and (3) Contractor withheld no sums from any subcontractor for allegations of deficiency in Work. The term "subcontractor", as used herein, includes all persons or firms furnishing work, materials, services or equipment Contractor ordered incorporated into Work or placed near the Project for which the City made partial payment.

EXCEPTION: Contractor sent Payment Notifications to the following subcontractors explaining why Contractor withheld payment. Copies are attached.

Subcontractor Name: _____ Subcontractor Name: _____

Street Address: _____ Street Address: _____

City, State, and Zip Code: _____ City, State, and Zip Code: _____

Amount of Payment Withheld: _____ Amount of Payment Withheld: _____

Date Payment First Withheld: _____ Date Payment First Withheld: _____

Description of Good Faith Reason: _____ Description of Good Faith Reason: _____

(Signature of Contractor's Representative)

(Print or Type Name of Contractor's Representative)

SWORN TO AND SUBSCRIBED before me on:

Date

Notary Public in and for the State of Texas

My Commission Expires: _____
Expiration Date

Print or Type Name of Notary Public

Instructions:

If Contractor withholds any amount of a payment to a Subcontractor for any reason, the Contractor shall send Payment Notifications to the Subcontractor explaining why the payment was withheld.

Contractor shall provide the City Monitoring Authority with Payment Notifications for each subcontractor from which Contractor has withheld payment. Contractor shall submit all necessary Payment Notifications (Document 00646), Payment Reporting Forms (Document 00642), and other documentation at the same time Contractor submits the Application and Certification for Payment or the Estimate for Payment.

Document 00646

PAYMENT NOTIFICATION – EXPLANATION OF WITHHOLDING

Legal Project Name: _____

Outline Agreement No.: _____ WBS No.: _____

Contractor's Company Name: _____

Address: _____

Date: _____

SUBCONTRACTOR PAYMENT INFORMATION:

Subcontractor Name: _____

Street Address: _____

City, State, and Zip Code: _____

Business Phone Number: _____

Amount of Subcontractor Invoice: _____

Amount of Payment Made: _____

Amount of Payment Withheld: _____

Date Payment First Withheld: _____

DETAILED EXPLANATION OF WITHHOLDING: _____

(Signature of Contractor's Representative)

(Print or Type Name of Contractor's Representative)

List of Changes:

- 02-04-2005: Added new Paragraph 3.25.1.3 concerning strict liability. Edited Paragraph 3.25.1.1 accordingly. Edited Paragraph 9.6.1.4 to remove the words "retainage of".
- 08-15-2006: Revised many references to Section(s) to read Paragraph(s). Added Small Business Enterprise (SBE) requirement to Paragraphs 3.5.3, 3.5.3.1, 3.5.3.2 and 3.5.3.3.
- 08-17-2006: Added new Paragraphs 5.2.4, 5.2.5, 9.2.1 and 9.4.2 concerning prompt payment provisions.
- 10-10-2006: Added new Paragraphs 9.7.1.8, 9.7.1.9 concerning prompt payment provisions. Changed 9.8.1 to "20 days", and added language to 9.8.2 concerning "7 calendar days" and payment disputes.
- 03-10-2008: Revised Table 1 after 11.2.11 (Installation Floater), and expanded Paragraph 11.5.1 on Maintenance Bonds.
- 09-10-2008: Revised 5.2.5[sic] on page 17 to read 5.2.4.
- 10-24-2008: Revised many sections to include or amend numbering.
- 08-01-2009: Amended 1.1.6., definition of City Engineer. Amended 2.2 to say "Duties" and added 2.2.2 stating that the contract imposes no implied duty on City. Added 3.5.4 concerning Contractor Participation in the Pay or Play Program. Added 3.28 pertaining to Contractor Debt. Amended 4.1.2 to prohibit the City Engineer from delegating signature authority under 4.4. Amended 4.1.11 stating that City owes no duty to Contractor not stated in contract. Amended 4.3.2 to delete second sentence concerning City Engineers decision as a condition precedent to litigation. Amended 4.6 to require both parties to wave claims, attorney fees, and interest. Amended 11.2.6 to require Contractor to notify the City of any Insurance Policy cancelation or modification. Amended 11.2.8 to exempt Workers' Compensation coverage from certain documentation requirements. Amended Table 1 after 11.2.11 to specify automobile coverage requirements. Added 11.3.3 to address content requirements on Certificates of Insurance. Added 13.3.2 to extend joint and several liability to any series, affiliate, subsidiary, or successor to which Contractor assigns or transfers assets. Amended throughout to standardize references to Sections (x.x), Paragraphs (x.x.x), and Subparagraphs (x.x.x.x and below).
- 01-15-2010: Amended Sections 4.4 and 4.6 concerning written decisions, findings of fact, and hearings by the City engineer, precedent to litigation, and interest under Chapter 2251 of the Texas Local Government Code. Removed Section 4.5 NON-BONDING MEDIATION and renumbered and renamed Section 4.6 as 4.5 CONDITION PRECEDENT TO SUIT; WAIVER OF ATTORNEY FEES AND INTEREST.
- 05-01-2010: Amended Subsection 1.1.5 to change "municipal corporation" to "home rule municipality". Amended Subsection 3.9.1.1 to reflect change from Low Sulfur Deisel Fuel (500 ppm) to Ultra Low Sulfur Fuel (15 ppm).
- 12-07-2010: Amended Section 14.1.1.5 to mirror change in Section 3.9.1.1; Low Sulfur Diesel Fuel was changed to Ultra Low Sulfur Fuel.
- 12-09-2010: Amended Section 4.5 (and Table of Contents) by adding "Interim Payment Waiver & Release" language from Document 00850. Amended Subsection 11.3 to include new insurance requirements.
- 12-10-2010: Inserted phrase into definition of Claim (§1.1.7) defining what a Claim can constitute

- 01-14-2011: *Insertion of terms "Business Enterprise" and "Business Enterprise Policy" into definition section (§1.1) and insertion of those terms in §3.5, as appropriate, and deletion of old §3.5.3*
- 01-18-2011: *Renaming of §4.5; renumbering of Table of Contents due to introduction of "Interim Payment Waiver & Release" as a separate section (§4.6)*
- 01-31-2011: *Edit of Section 4.6, Interim Payment Waiver & Release" to reflect language suggestions of Litigation Division of Legal Dept.*
- 02-09-2011: *Edit of language in definitions of "Business Enterprise" and "Business Enterprise Policy"*
- 10-12-2011: *Amended Section 8.2, related to delays and extensions of time, to strengthen language suggested in 2011 Construction Law CLE.*
- 10-19-2011: *General reformatting of entire document for consistency; updating of header re: date; insertion of "Mayor's Office of Business Opportunity", as appropriate, to reflect name change*
- 10-27-2011: *Added a definition for "Mayor's Office of Business Opportunity"; amended Section 8.2.2 to refer to Section 4.3.6.2; replaced MWBE with "Business Enterprise", where appropriate; added "persons, or entities" to Section 5.1 to broaden applicable provisions; updated issue date to proposed Issue date of November 1, 2011.*
- 10-31-2011: *edited definition of "Business Enterprise"*
- 07-01-2013: *Edited Section 3.5.3 to remove the binding arbitration requirement for contractor and subcontractor claims, per change in Office of Business Opportunity policy.*
- 07-25-2013: *Removed Section 4.5.1, regarding conditions precedent to suit.*
- 11-01-2014: *Changed Section 3.5.2 to reflect a move away from arbitration to mediation to resolve subcontractor disputes; removed requirement for City Engineer's decision before a suit may be brought from Section 4.5.2; included language in Section 5.1.3 requiring submission of written contracts with Subcontractors within 30 days of Notice to Proceed issuance; changed Section 11.2 to reflect required insurance coverages updated for new fiscal year; added more explicit language regarding the City's Additional Insured status in Section 11.2.4 ("Insured Parties") and the City's waiver of subrogation requirement in Section 11.2.7 ("Subrogation").*
- 01-01-2015: *Changed the Automobile Insurance requirement from \$2,000,000 to \$1,000,000.*

Document 00700

GENERAL CONDITIONS

January 1, 2015 EDITION

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ARTICLE 1 - GENERAL PROVISIONS

1.1 DEFINITIONS

1.1.1 *Agreement:* Document signed by the Parties and binding the Parties, containing the name of Contractor, title and location of the Project, Original Contract Time, Original Contract Price, enumeration of documents included in the Contract, and other provisions.

1.1.2 *Bonds:* Performance Bond, Payment Bond, Maintenance Bond, and other Surety instruments executed by Surety. When in singular form, refers to individual instrument.

1.1.3 *Business Enterprise:* Any business entity registered in a program authorized by 49 C.F.R. § 26 (where applicable) or City Code of Ordinances, Chapter 15, Article II, relating to Equal Opportunity Employment and taking affirmative action to ensure that applicants are employed and employees are treated without regard to race, religion, color, sex, national origin, or age. The term "Business Enterprise" may include any Disadvantaged Business Enterprise ("DBE"), Minority Business Enterprise ("MBE"), Woman Business Enterprise ("WBE"), Small Business Enterprise ("SBE"), Person with Disability Enterprise ("PDBE"), and any Historically Underutilized Business ("HUB").

1.1.4 *Business Enterprise Policy:* Contract documents and applicable policies relating to Business Enterprises and authorized under 49 C.F.R. § 26 or City Code of Ordinances, Chapter 15, Article II.

1.1.5 *Cash Allowance:* An estimated sum of money to be used only for a limited class of expenditures such as utility relocation costs, fees for special licenses or permits, or other "pass-through" costs that would be the same for any contractor. Cash Allowances may not be used to purchase goods or services that are not specified in the Contract. The unspecified items must be purchased according to the terms of Article 7.

1.1.6 *Change Order:* Written instrument prepared by the City and signed by City Engineer and Contractor, specifying the following:

- .1 a change in the Work;
- .2 a change in Contract Price, if any; and
- .3 a change in Contract Time, if any.

The value of a Change Order is the net amount after offsetting all deductions against all additions effected by the Change Order.

1.1.7 *City:* The City of Houston, a home rule municipality located principally within Harris County, Texas, including its successors and its authorized representatives.

1.1.8 *City Engineer:* The City Engineer, or the City employee representing the City Engineer, designated in the Agreement and authorized to represent the City, or successors.

1.1.9 *Claim:* Written demand or written assertion by one Party seeking adjustment of the Contract, payment of money, extension of time, or other relief under the Contract and includes, but is not limited to, claims for materials, labor, equipment, delay, changes, adjustments, substitutions, fees and third party claims. The Party making the Claim has the responsibility to substantiate the Claim.

1.1.10 *Conditions of the Contract:* General Conditions and Supplementary Conditions.

1.1.11 *Construction Manager:* Person or firm under contract with the City as its authorized representative to oversee and administer construction of the Work, and who may perform the role of Project Manager and Inspector, as designated by City Engineer in writing.

1.1.12 *Contract:* The Agreement; documents enumerated in and incorporated into the Agreement, Modifications, and amendments.

1.1.13 *Contract Price:* The monetary amount stated in the Agreement adjusted by Change Order, and increases or decreases in Unit Price Quantities, if any.

1.1.14 *Contract Time:* The number of days stated in the Agreement to substantially complete the Work, plus days authorized by Change Order.

1.1.15 *Contractor:* Person or firm identified as such in the Agreement including its successors and its authorized representatives.

1.1.16 *Date of Commencement of the Work:* Date established in Notice to Proceed on which Contract Time will commence. This date will not be changed by failure of Contractor, or persons or entities for whom Contractor is responsible, to act.

1.1.17 *Date of Substantial Completion:* Date that construction, or portion thereof designated by City Engineer, is certified by City Engineer to be substantially complete.

1.1.18 Design Consultant: Person or firm, under contract with the City, to provide professional services during construction and its authorized representatives. If a Design Consultant is not employed for services during construction, Project Manager will perform duties of Design Consultant designated in the Contract in addition to usual duties of Project Manager.

1.1.19 Drawings: Graphic and pictorial portions of the Contract that define the character and scope of the Work.

1.1.20 Extra Unit Price: Unit Prices, which may be required for completion of the Work. These Unit Prices and Unit Price Quantities are in the Contract and are included in Original Contract Price.

1.1.21 Furnish: To supply, pay for, deliver to the site, and unload.

1.1.22 General Requirements: The sections of Division 01 Specifications that specify administrative and procedural requirements and temporary facilities required for the Work.

1.1.23 Inspector: City's employee or agent authorized to assist with inspection of the Work.

1.1.24 Install: Unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, clean, protect, and similar operations.

1.1.25 Legal Holiday: Day established by the City Council as a holiday.

1.1.26 Major Unit Price Work: An individual Unit Price item,

- .1 whose value is greater than five percent of Original Contract Price,
- .2 whose value becomes greater than five percent of Original Contract Price as the result of an increase in quantity, or
- .3 whose value is \$100,000, whichever is least.

1.1.27 Mayor's Office of Business Opportunity: any reference to, or use of, the "Office of Affirmative Action" shall mean the Mayor's Office of Business Opportunity, or any such future name to which it is changed.

1.1.28 Minor Change in the Work: A written change in the Work, ordered by City Engineer, that does not change Contract Price or Contract Time, and that is consistent with the general scope of the Contract.

1.1.29 Modification: Change Order, Work Change Directive, or Minor Change in the Work.

1.1.30 Notice of Noncompliance: A written notice by City Engineer to Contractor regarding defective or nonconforming work that does not meet the Contract requirements, and that establishes a time by which Contractor shall correct the defective or nonconforming work.

1.1.31 Notice to Proceed: A written notice by City Engineer to Contractor establishing Date of Commencement of the Work.

1.1.32 Original Contract Price: The monetary amount originally stated in the Agreement.

1.1.33 Parties: Contractor and the City. When in singular form, refers to Contractor or the City.

1.1.34 Pollutant: Any materials subject to the Texas Solid Waste Disposal Act.

1.1.35 Pollutant Facility: Any facility regulated by the State of Texas to protect the health and environment from contamination by Pollutants, including without limitation, landfills, oil and gas production and storage facilities, wastewater facilities, waste injection wells, and storage tanks (including drums).

1.1.36 Product: Materials, equipment, or systems incorporated into the Work or to be incorporated into the Work.

1.1.37 Product Data: Illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by Contractor to illustrate a Product.

1.1.38 Project: Total construction, of which the Work performed under the Contract may be the whole or a part, and which may include construction by the City or by separate contractors.

1.1.39 Project Manager: City Engineer's authorized representative for administration of the Work. Titles used within the City's departments may be different than those used in this definition.

1.1.40 Provide: Furnish and Install, complete, ready for intended use.

1.1.41 Samples: Physical examples that illustrate Products, or workmanship, and establish standards by which the Work is judged.

1.1.42 *Shop Drawings:* Drawings, diagrams, schedules, and other data specially prepared for the Work by Contractor, Subcontractor or Supplier, to illustrate a portion of the Work.

1.1.43 *Specifications:* Divisions 01 through 16 of the documents that are incorporated into the Agreement, consisting of written General Requirements and requirements for Products, standards, and workmanship for the Work, and performance of related services.

1.1.44 *Stipulated Price:* Single lump sum amount stated in the Contract for completion of the Work, or for designated portion of the Work.

1.1.45 *Subcontractor:* Person or firm that has direct or indirect contract with Contractor or with another Subcontractor to perform a portion of the Work and its authorized representatives.

1.1.46 *Superintendent:* Employee of Contractor having authority and responsibility to act for and represent Contractor.

1.1.47 *Supplementary Conditions:* Part of Conditions of the Contract that amends or supplements General Conditions.

1.1.48 *Supplier:* Manufacturer, distributor, materialman, or vendor having a direct agreement with Contractor or Subcontractor for Products, or services and its authorized representatives.

1.1.49 *Surety:* Corporate entity that is bound by one or more Bonds, and is responsible for completion of the Work, including the correction period, and for payment of debts incurred in fulfilling the Contract. Surety shall include co-surety or reinsurer, as applicable.

1.1.50 *Underground Facilities:* Pipes, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments and encasements containing such facilities that exist below ground level.

1.1.51 *Unit Price:* An amount stated in the Contract for an individual, measurable item of work, which, when multiplied by actual quantity incorporated into the Work, amounts to full compensation for completion of the item, including work incidental to it.

1.1.52 *Unit Price Quantities:* Quantities indicated in the Contract that are approximations made by the City for contracting purposes.

1.1.53 *Work:* Entire construction required by the Contract, including all labor, Products, and services provided by Contractor to fulfill Contractor's obligations. The Work may constitute the whole or a portion of the Project.

1.1.54 *Work Change Directive:* A written change in the Work, ordered by City Engineer, that is within the general scope of the Contract and consisting of additions, deletions, or other revisions. A Work Change Directive will state proposed basis for adjustment, if any, in Contract Price or Contract Time, or both.

1.2 *EXECUTION, CORRELATION, AND INTENT*

1.2.1 Execution of the Contract by Contractor is conclusive that Contractor has visited the Work site, become familiar with local conditions under which the Work will be performed, and fully informed itself as to conditions and matters which can affect the Work or costs. Contractor further agrees that it has carefully correlated personal observations with requirements of the Contract.

1.2.2 The Contract and Modifications have been read and carefully considered by Contractor, who understands and agrees to their sufficiency for the Work. The Contract may not be more strongly construed against the City than against Contractor and Surety.

1.2.3 Contractor shall include all items necessary for proper execution and completion of the Work.

1.2.4 Reference to standard specifications, manuals, or codes of a technical society, organization, or association, or to laws or regulations of a governmental authority, whether specific or implied, mean the latest edition in effect as of date of receipt of bids, except as may be otherwise specifically stated in the Contract.

1.2.5 No provision of any referenced standard, specification, or manual changes the duties and responsibilities of the City, City Engineer, Contractor, or Design Consultant from those set forth in the Contract. Nor do these provisions assign to Design Consultant any duty or authority to supervise or direct performance of the Work or any duty or

authority to undertake any actions contrary to provisions of the Contract.

1.2.6 Organization of Specifications into divisions, sections, and articles and arrangement of Drawings does not control Contractor in dividing the Work among Subcontractors or in establishing the extent of work to be performed by any trade.

1.2.7 Unless otherwise defined in the Contract, words which have well-known construction industry technical meanings are used in the Contract in accordance with these recognized meanings.

1.3 *OWNERSHIP AND USE OF DOCUMENTS*

1.3.1 Drawings, Specifications, and other documents prepared by the City or by Design Consultant are instruments of service through which the Work to be executed by Contractor is described. Contractor may retain one Contract record set.

1.3.2 Neither Contractor, Subcontractor, nor Supplier will own or claim a copyright to documents contained in the Contract or any part of the Contract.

1.3.3 Documents contained in the Contract, prepared by the City or by Design Consultant, and copies furnished to Contractor, are for use solely with respect to the Work. They may not be used by Contractor, Subcontractor or Supplier on other projects or for additions to the Work, outside the scope of the Work, without the specific written consent of City Engineer, and Design Consultant, when applicable.

1.3.4 Contractor, Subcontractors, and Suppliers are granted a limited license to use and reproduce applicable portions of the Contract appropriate to and for use in execution of their work under the Contract.

1.4 *INTERPRETATION*

1.4.1 Specifications are written in an imperative streamlined form and are directed to Contractor, unless noted otherwise. When written in this form, words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

1.4.2 In the interest of brevity, the Contract frequently omits modifying words such as "all" and "any" and articles such as "the" and "an", but an absent modifier or article is not intended to affect interpretation of a statement.

ARTICLE 2 - THE CITY

2.1 *LIMITATIONS OF THE CITY'S OFFICERS AND EMPLOYEES*

2.1.1 No officer or employee of the City may authorize Contractor to perform an act or work contrary to the Contract, except as otherwise provided in the Contract.

2.2 *DUTIES OF THE CITY*

2.2.1 If a building permit is required, the City will process an application for, and Contractor shall purchase the building permit before Date of Commencement of the Work.

2.2.2 The City will make available to Contractor a reproducible set of Drawings. Additional copies will be furnished, on Contractor's request, at the cost of reproduction.

2.2.3 When necessary for performance of the Work, the City will provide surveys describing physical characteristics, legal limitations, legal description of site, and horizontal and vertical control adequate to lay out the Work.

2.2.4 Information or services that the City is required to provide under the Contract will be provided by the City with reasonable promptness to avoid delay in orderly progress of the Work.

2.2.5 The Contract imposes no implied duty on the City. The City does not warrant any plans or specifications associated with the Contract.

2.2.6 Except as expressly stated in this Article, the City owes no duty to the Contractor or any subcontractor.

2.3 *AVAILABILITY OF LAND AND USE OF SITE*

2.3.1 The City will furnish, as indicated in the Contract, rights-of-way, land on which the Work is to be performed, and other land designated in the Contract for use by Contractor unless otherwise provided in the Contract.

2.3.2 Contractor shall confine operations at site to those areas permitted by law, ordinances, permits, and the Contract, and may not unreasonably encumber site with materials or equipment.

2.3.3 In addition to land provided by the City under Section 2.3, Contractor shall provide all land and access to land that may be required for use by Contractor for temporary construction facilities or for storage of materials and equipment, and shall indemnify the City during its use of the land as stated in Section 3.25.

2.4 *THE CITY'S RIGHT TO STOP THE WORK*

2.4.1 If Contractor fails to carry out the Work in accordance with the Contract, or fails to correct work which is not in accordance with requirements of the Contract as required in Sections 12.1 and 12.2, the City may, by Notice of Noncompliance, order Contractor to stop the Work or any portion of the Work until the cause for the order has been eliminated. However, the right of the City to stop the Work will not give rise to a Claim for delay or to a duty on the part of the City to exercise this right for the benefit of Contractor or any other person or entity, except to the extent required by Section 6.2. If Contractor corrects the defective or nonconforming work within the time established in Notice of Noncompliance, City Engineer will give written notice to Contractor to resume performance of the Work.

2.5 *THE CITY'S RIGHT TO CARRY OUT WORK*

2.5.1 If Contractor fails to carry out work in accordance with the Contract, and fails within the period established in a Notice of Noncompliance to correct the nonconforming work, the City may, after expiration of the required period, correct the deficiencies without prejudice to other remedies the City may have, including rights of the City under Section 14.1.

2.5.1.1 When the City corrects deficiencies, City Engineer will issue an appropriate Change Order and deduct from payments then or thereafter due Contractor the cost of correcting the deficiencies, including compensation for Design Consultant's and Construction Manager's additional services and expenses made necessary by such default, neglect, or failure. This action by the City and amounts charged to Contractor are both subject to prior approval of City Engineer. If payments, then or thereafter due Contractor, are not sufficient to cover these amounts, Contractor shall pay the difference to the City.

2.5.2 Notwithstanding the City's right to carry out work, maintenance and protection of the Work

remains Contractor's responsibility, as provided in the Contract.

ARTICLE 3 - CONTRACTOR

3.1 *RESPONSIBILITIES*

3.1.1 Contractor shall maintain office with agent in the greater City of Houston area during the Contractor's performance under the Contract. Contractor shall file its street address with City Engineer.

3.1.2 Contractor and Contractor's employees shall not give or lend money or anything of value to an officer or employee of the City. Should this Paragraph 3.1.2 be violated, City Engineer may terminate the Contract under Section 14.1.

3.2 *REVIEW OF CONTRACT AND FIELD CONDITIONS BY CONTRACTOR*

3.2.1 Contractor shall carefully study and compare documents contained in the Contract with each other and with information furnished by the City pursuant to Section 2.2 and shall immediately report, in writing, any errors, inconsistencies, or omissions to City Engineer. If work is affected, Contractor shall obtain a written interpretation or clarification from City Engineer before proceeding with the affected work. However, Contractor will not be liable to the City for failure to report an error, inconsistency, or omission in the Contract unless Contractor had actual knowledge or should have had knowledge of the error, inconsistency, or omission.

3.2.2 Contractor shall take field measurements and verify field conditions, and shall carefully compare the conditions and other information known to Contractor with the Contract, before commencing activities. Contractor shall immediately report, in writing, to City Engineer for interpretation or clarification of discrepancies, inconsistencies, or omissions discovered during this process.

3.2.3 Contractor shall make a reasonable attempt to understand the Contract before requesting interpretation from City Engineer.

3.3 *SUPERVISION AND CONSTRUCTION PROCEDURES*

3.3.1 Contractor shall supervise, direct, and inspect the Work competently and efficiently, devoting the attention and applying the skills and

expertise as necessary to perform the Work in accordance with the Contract. Contractor is solely responsible and has control over construction means, methods, techniques, sequences, and procedures of construction; for safety precautions and programs in connection with the Work; and for coordinating all work under the Contract.

3.3.2 Regardless of observations or inspections by the City or City's consultants, Contractor shall perform and complete the Work in accordance with the Contract and submittals approved pursuant to Section 3.18. The City is not liable or responsible to Contractor or Surety for work performed by Contractor that is not in accordance with the Contract regardless of whether discovered during construction or after acceptance of the Work.

3.4 SUPERINTENDENT

3.4.1 Contractor shall employ a competent Superintendent and necessary assistants who shall be present at the site during performance of the Work. Communications given to Superintendent are binding on the Contractor.

3.4.2 Contractor shall notify City Engineer in writing of its intent to replace the Superintendent. Contractor may not replace the Superintendent if City Engineer makes a reasonable objection in writing.

3.5 LABOR

3.5.1 Contractor shall provide competent, qualified personnel to survey and lay out the Work and perform construction as required by the Contract. The City may, by written notice, require Contractor to remove from the Work any employee of Contractor or Subcontractors to whom City Engineer makes reasonable objection.

3.5.2 Contractor shall comply with the applicable Business Enterprise Policy set out in this Agreement and in the Supplementary Conditions, as set out in Chapter 15, Article V of the City of Houston Code of Ordinances.

3.5.3 When Original Contract Price is greater than \$1,000,000, Contractor shall make Good Faith Efforts to award subcontracts or supply agreements in at least the percentages set out in the Supplementary Conditions for Business Enterprise Policy. Contractor acknowledges that it has reviewed the requirements for Good Faith Efforts on file with the City's Office of Business Opportunity and shall comply with them.

3.5.3.1 Contractor shall require written subcontracts with Business Enterprises and shall submit all disputes with Business Enterprises to voluntary mediation. Business Enterprise subcontracts complying with City Code of Ordinances Chapter 15, Article II must contain the terms set out in Subparagraph 3.5.3.2. If Contractor is an individual person, as distinguished from a corporation, partnership, or other legal entity, and the amount of the subcontract is \$50,000 or less, the subcontract must also be signed by the attorneys of the respective parties.

3.5.3.2 Contractor shall ensure that subcontracts with Business Enterprise firms are clearly labeled "**THIS CONTRACT MAY BE SUBJECT TO MEDIATION ACCORDING TO THE TEXAS ALTERNATIVE DISPUTE RESOLUTION ACT**" and contain the following terms:

- .1 (Business Enterprise) may not delegate or subcontract more than 50 percent of work under this subcontract to any other subcontractor without the express written consent of the City's OBO Director (the "Director").
- .2 (Business Enterprise) shall permit representatives of the City of Houston, at all reasonable times, to perform (1) audits of the books and records of the Subcontractors and Suppliers, and (2) inspections of all places where work is to be undertaken in connection with this subcontract. (Business Enterprise) shall keep the books and records available for this purpose for at least four years after the end of its performance under this subcontract. Nothing in this provision shall affect the time for bringing a cause of action nor the applicable statute of limitations.
- .3 Within five business days of execution of this subcontract, Contractor and (Business Enterprise) shall designate in writing to the Director an agent for receiving any notice required or permitted to be given pursuant to Chapter 15 of the Houston City Code of Ordinances, along with the street and mailing address and phone number of the agent.

3.5.4 The requirements and terms of the City of Houston Pay or Play Program, as set out in Executive Order 1-7 and Ordinance 2007-0534, are incorporated into the Contract for all purposes. Contractor shall comply with the terms and conditions of the Pay or Play Program as they are set out at the time of City Council approval of this

agreement. IF CONTRACTOR DOES NOT PAY IN ACCORDANCE WITH THE PAY OR PLAY PROGRAM WITHIN 30 DAYS OF THE DATE CITY ENGINEER SENDS CONTRACTOR WRITTEN NOTIFICATION, CITY CONTROLLER MAY DEDUCT FUNDS UP TO THE AMOUNT OWED FROM ANY PAYMENTS OWED TO CONTRACTOR UNDER THIS AGREEMENT, AND CONTRACTOR WAIVES ANY RECOURSE.

3.6 *PREVAILING WAGE RATES*

3.6.1 Contractor shall comply with governing statutes providing for labor classification of wage scales for each craft or type of laborer, worker, or mechanic.

3.6.2 Prevailing wage rates applicable to the Work may be one or a combination of the following wage rates identified in Division 00:

- .1 Federal Wage Rate General Decisions
 - .1 Highway Rates
 - .2 Building Rates
 - .3 Heavy Construction Rates
 - .4 Residential Rates
- .2 City Prevailing Wage Rates
 - .1 Building Construction Rates
 - .2 Engineering Construction Rates
 - .3 Asbestos Worker Rates

3.6.3 Each week Contractor shall submit to the City's Mayor's Office of Business Opportunity certified copies of payrolls showing classifications and wages paid by Contractor, Subcontractors, and Suppliers for each employee under the Contract, for any day included in the Contract.

3.7 *LABOR CONDITIONS*

3.7.1 In the event of labor disputes affecting Contractor or Contractor's employees, Contractor shall utilize all possible means to resolve disputes in order that the Work not be delayed to any extent. These means will include seeking injunctive relief and filing unfair labor practice charges, and any other action available to Contractor.

3.7.2 When Contractor has knowledge that any actual or potential labor dispute is delaying or is threatening to delay timely performance of the Work, Contractor shall immediately notify City Engineer in writing. No Claims will be accepted by City Engineer for costs incurred as a result of jurisdictional or labor disputes.

3.8 *DRUG DETECTION AND DETERRENCE*

3.8.1 It is the policy of the City to achieve a drug-free work force and to provide a workplace that is free from the use of illegal drugs and alcohol. It is also the policy of the City that manufacture, distribution, dispensation, possession, sale, or use of illegal drugs or alcohol by contractors while on the City's premises is prohibited. By executing the Contract, Contractor represents and certifies that it meets and will comply with all requirements and procedures set forth in the Mayor's Policy on Drug Detection and Deterrence, City Council Motion No. 92-1971 ("Mayor's Policy") and the Mayor's Drug Detection and Deterrence Procedures for Contractors, Executive Order No. 1-31, (Revised) ("Executive Order"). Mayor's Policy is on file in the office of the City Secretary. Copies of Executive Order may be obtained at the location specified in the Advertisement for Bids.

3.8.1.1 The Executive Order applies to the City's contracts for labor or services except the following:

- .1 contracts authorized by Emergency Purchase Orders,
- .2 contracts in which imposition of requirements of the Executive Order would exclude all potential bidders or proposers, or would eliminate meaningful competition for the Contract,
- .3 contracts with companies that have fewer than 15 employees during any 20-week period during a calendar year and no safety impact positions,
- .4 contracts with non-profit organizations providing services at no cost or reduced cost to the public, and
- .5 contracts with federal, state, or local governmental entities.

3.8.1.2 Prior to execution of the Contract, Contractor shall have filed with the City:

- .1 a Drug Policy Compliance Agreement form (Attachment "A" to the Executive Order), and
- .2 a copy of Contractor's drug free workplace policy, and
- .3 a written designation of all safety impact positions, if applicable, or a Contractor's Certification of a No Safety Impact Positions form (Attachment "C" to the Executive Order).

3.8.1.3 Every six months during performance of the Contract and upon completion of the Contract, Contractor shall file a Drug Policy Compliance Declaration form (Attachment "B" to the Executive Order). The Contractor shall submit the Drug Policy Compliance Declaration within 30 days of expiration of each six-month period of performance and within 30 days of completion of the Contract. The first six-month period shall begin on Date of Commencement of the Work.

3.8.1.4 Contractor shall have a continuing obligation to file updated designation of safety impact positions when additional safety impact positions are added to Contractor's employee workforce during performance of the Work.

3.8.1.5 Contractor shall require its Subcontractors and Suppliers to comply with the Mayor's Policy and Executive Order. Contractor is responsible for securing and maintaining required documents from Subcontractors and Suppliers for the City inspection throughout the term of the Contract.

3.8.1.6 Failure of Contractor to comply with requirements will be a material breach of the Contract entitling the City to terminate in accordance with Section 14.1.

3.9 MATERIALS & EQUIPMENT

3.9.1 Unless otherwise provided in the Contract, Contractor shall provide and assume full responsibility for Products, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, transportation, temporary facilities, supplies, and other facilities and incidentals necessary for Furnishing, performing, testing, starting-up, and completing the Work.

3.9.1.1 Contractor, Subcontractors, and Suppliers shall use Ultra Low Sulfur Diesel Fuel in all diesel operating vehicles and motorized equipment utilized in performing the Work. Ultra Low Sulfur Diesel Fuel is defined as diesel fuel having 15 ppm or the applicable standard set by state or federal law or rules and regulations of the Texas Commission on Environmental Quality, or the Environmental Protection Agency, whichever is less in sulfur content. Off-road Ultra Low Sulfur Diesel Fuel may be used in lieu of on-road Ultra Low Sulfur Diesel Fuel. Contractor shall provide, upon request by City Engineer, proof that Contractor, Subcontractors, and Suppliers are using Ultra Low Sulfur Diesel Fuel.

3.9.2 Contractor shall provide Products that are:

- .1 new, unless otherwise required or permitted by the Contract, and
- .2 of specified quality.

If required by City Engineer, Contractor shall furnish satisfactory evidence, including reports of required tests, as to kind and quality of Products.

3.9.3 Contractor shall store Products in a safe, neat, compact, and protected manner. Contractor shall also store Products delivered during the work, along the right-of-way:

- .1 so as to cause the least inconvenience to property owners, tenants, and general public; and
- .2 so as not to block access to, or be closer than, three feet to any fire hydrant.

Contractor shall protect trees, lawns, walks, drives, streets, and other improvements that are to remain, from damage. If private or public property is damaged by Contractor, Contractor shall, at its sole expense, restore the damaged property to at least its original condition.

3.9.3.1 Contractor shall obtain City Engineer's approval for storage areas used for Products for which payment has been requested under Paragraph 9.6.1. Contractor shall provide the City access to the storage areas for inspection purposes. Products, once paid for by the City, become the property of the City and may not be removed from place of storage, without City Engineer's written permission except for a movement to the site. Contractor's Installation Floater, required under Section 11.2, shall cover all perils, including loss or damage to Products during storage, loading, unloading, and transit to the site.

3.10 PRODUCT OPTIONS AND SUBSTITUTIONS

3.10.1 For Products specified by reference standards or by description only, Contractor may provide any Product meeting those standards or description.

3.10.2 For Products specified by naming one or more manufacturers with provision for substitutions or equal, Contractor may submit a request for substitution for any manufacturer not named.

3.10.3 City Engineer will consider requests for substitutions only within the first 15 percent of Contract Time, or first 90 days after date of Notice to Proceed, whichever is less.

3.10.4 Contractor shall document each request for substitution with complete data

substantiating compliance of proposed substitution with the Contract.

3.10.5 A request for substitution constitutes a representation that Contractor:

- .1 has investigated the proposed Product and determined that it meets or exceeds the quality level of the specified Product;
- .2 shall provide the same warranty for the substitution as for the specified Product;
- .3 shall coordinate installation of the proposed substitution and make changes to other work which may be required for the Work to be completed, with no additional cost or increase in time to the City;
- .4 confirms that cost data is complete and includes all related costs under the Contract;
- .5 waives Claim for additional costs or time extensions that may subsequently become apparent; and
- .6 shall provide review or redesign services by a design consultant with appropriate professional license and shall obtain re-approval and permits from authorities.

3.10.6 City Engineer will not consider and will not approve substitutions when:

- .1 they are indicated or implied on Shop Drawing or Product Data submittals without separate written request; or
- .2 acceptance will require revision to the Contract.

3.10.7 City Engineer may reject requests for substitution, and his decision will be final and binding on the Parties.

3.11 CASH ALLOWANCES

3.11.1 Contract Price includes Cash Allowances as identified in the Contract.

3.11.2 The City will pay the actual costs of Cash Allowance item exclusive of profit, overhead or administrative costs. If actual costs exceed the Cash Allowance, City Engineer must approve a Change Order for the additional costs.

3.12 WARRANTY

3.12.1 Contractor warrants to the City that Products furnished under the Contract are:

- .1 free of defects in title;
- .2 of good quality; and
- .3 new, unless otherwise required or permitted by the Contract.

If required by the City Engineer, Contractor shall furnish satisfactory evidence as to kind, quality and title of Products, and that Products conform to requirements of the Contract.

3.12.2 In the event of a defect in a Product, either during construction or warranty period, Contractor shall take appropriate action with manufacturer of Product to assure correction or replacement of defective Product with minimum delay.

3.12.3 Contractor warrants that the Work is free of defects not inherent in the quality required or permitted, and that the Work does conform with the requirements of the Contract. Contractor further warrants that the Work has been performed in a thorough and workmanlike manner.

3.12.4 Contractor warrants that the Work is free of concentrations on polychlorinated biphenyl (PCB) and other substances defined as hazardous by the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) or any other applicable law or regulation.

3.12.5 Work not conforming to requirements of Section 3.12, including substitutions not properly approved and authorized, may be considered nonconforming work.

3.12.6 Contractor's warranty excludes remedy for damage or defect caused by:

- .1 improper or insufficient maintenance by the City;
- .2 normal wear and tear under normal usage; or
- .3 claim that hazardous material was incorporated into the Work, if that material was specified in the Contract.

3.12.7 Contractor warrants that title to all work covered by Contractor's request for payment passes to the City upon incorporation into the Work or upon Contractor's receipt of payment, whichever occurs first. The Contractor further warrants that the title is free of all liens, claims, security interests or other interests ("Encumbrances"). If not, upon written demand from City Engineer, Contractor shall immediately take legal action necessary to remove Encumbrances.

3.13 **TAXES**

3.13.1 Contractor shall pay all sales, consumer, use, and similar taxes, which are in effect or scheduled to go into effect on or before bids are received, related to work provided by Contractor.

3.13.2 Contractor shall obtain, and require Subcontractors and Suppliers to obtain, necessary permits from the state and local taxing authorities to perform contractual obligations under the Contract, including sales tax permits.

3.13.3 The City is exempt from the Federal Transportation and Excise Tax. Contractor shall comply with federal regulations governing the exemptions.

3.13.4 Products incorporated into the Work are exempt from state sales tax according to provisions of the TEX. TAX CODE ANN. CH. 151, Subsection H.

3.14 **PERMITS, FEES, AND NOTICES**

3.14.1 Unless otherwise provided in the Contract, Contractor shall secure and pay for all construction permits, licenses, and inspections:

- .1 necessary for proper execution and completion of the Work; and
- .2 legally required at time bids are received.

3.15 **CONSTRUCTION SCHEDULES**

3.15.1 On receipt of Notice to Proceed, Contractor shall promptly prepare and submit construction schedule for the Work for City Engineer's review. The schedule must reflect the minimum time required to complete the Work not to exceed Contract Time.

3.15.2 Contractor shall give 24-hour written notice to City Engineer before commencing work or resuming work where work has been stopped. Contractor shall also give the same notice to inspectors.

3.15.3 Contractor shall incorporate milestones specified in Summary of Work Specification into the construction schedule. Contractor's failure to meet a milestone, as determined by City Engineer, may be considered a material breach of the Contract.

3.15.4 Each month, Contractor shall submit to City Engineer a copy of an updated construction schedule indicating actual progress, incorporating applicable changes, and indicating courses of action

required to assure completion of the Work within Contract Time.

3.15.5 Contractor shall keep a current schedule of submittals that coordinates with the construction schedule, and shall submit the initial schedule of submittals to City Engineer for approval.

3.16 **DOCUMENTS AND SAMPLES AT THE SITE**

3.16.1 Contractor shall maintain at the site, and make available to City Engineer, one record copy of Drawings, Specifications, and Modifications. Contractor shall maintain the documents in good order and marked currently to record changes and selections made during construction. In addition, Contractor shall maintain at the site, approved Shop Drawings, Product Data, Samples, and similar submittals, which will be delivered to City Engineer prior to final inspection as required in Paragraph 9.11.4.

3.16.2 Contractor shall maintain all books, documents, papers, accounting records, and other relevant documentation pursuant to the Work and shall make the books, documents, papers, and accounting records available to representatives of the City for review and audits during the Contract term and for the greater of three years following Date of Substantial Completion or until all litigation or audits are fully resolved.

3.16.3 Contractor shall provide to City Attorney all documents and records that City Attorney deems necessary to assist in determining Contractor's compliance with the Contract, with the exception of those documents made confidential by federal or state law or regulation.

3.17 **MANUFACTURER'S SPECIFICATIONS**

3.17.1 Contractor shall handle, store, and Install Products and perform all work in the manner required by Product manufacturer. Should the Contract and manufacturer's instructions conflict, Contractor shall report conflict to City Engineer for resolution prior to proceeding with the affected work.

3.17.2 References in the Contract to the manufacturer's specifications, directions, or recommendations, mean manufacturer's current published documents in effect as of date of receipt of bids, or in the case of a Modification, as of date of Modification.

**3.18 SHOP DRAWINGS, PRODUCT DATA,
AND SAMPLES**

3.18.1 Shop Drawings, Product Data, and Samples are not part of the Contract. The purpose of Contractor submittals is to demonstrate, for those portions of the Work for which submittals are required, the way Contractor proposes to conform to information given and design concept expressed in the Contract.

3.18.2 Contractor shall submit to Project Manager for review the Shop Drawings, Product Data, and Samples, which are required by the Contract. Review by Project Manager is subject to limitations of Paragraph 4.1.4. Contractor shall transmit the submittals to the Project Manager with reasonable promptness and in a sequence, so as to cause no delay in the Work or in activities of the City or of separate contractors. Contractor shall transmit submittals in time to allow a minimum of 30 days for Project Manager's review prior to date Contractor needs reviewed submittals returned. This time may be shortened for a particular job requirement if approved by Project Manager in advance of submittal.

3.18.3 Contractor shall certify that the content of submittals conforms to the Contract without exception by affixing Contractor's approval stamp and signature. By certifying and submitting Shop Drawings, Product Data, and Samples, Contractor represents, and Contractor's stamp of approval shall state, that Contractor has determined and verified materials, quantities, field measurements, and field construction criteria related to the submittal, and has checked and coordinated information contained within the submittals with requirements of the Contract.

3.18.4 Contractor may not perform any work requiring submittal and review of Shop Drawings, Product Data, or Samples until the submittal has been returned with appropriate review decision by the Project Manager. Contractor shall perform work in accordance with the review.

3.18.5 If Contractor performs any work requiring submittals prior to review and acceptance of the submittals by Project Manager, such work is at Contractor's risk and the City is not obligated to accept work if the submittals are later found to be unacceptable.

3.18.6 If, in the opinion of Project Manager, the submittals are incomplete, or demonstrate an inadequate understanding of the Work or lack of

review by the Contractor, then submittals may be returned to the Contractor for correction and resubmittal.

3.18.7 Contractor shall direct specific attention in writing and on the resubmitted Shop Drawings, Product Data, or Samples to any additional proposed revisions, other than those revisions requested by Project Manager on previous submittals.

3.18.8 Contractor is not relieved of responsibility for deviations from requirements of the Contract by Project Manager's review of Shop Drawings, Product Data, or Samples unless Contractor has specifically informed Project Manager in writing of the deviation at the time of the submittal, and Project Manager has given written approval of the deviation.

3.18.9 When professional certification of performance criteria of Products is required by the Contract, the City may rely upon accuracy and completeness of the calculations and certifications.

3.18.10 For Product colors or textures to be selected by the City, Contractor shall submit all samples together to allow preparation of a complete selection schedule.

3.18.11 Contractor shall submit informational submittals, on which Project Manager is not expected to take responsive action, as required by the Contract.

3.18.12 Submittals made by Contractor which are not required by the Contract may be returned to Contractor without action.

**3.19 CULTURAL RESOURCES AND
ENDANGERED SPECIES**

3.19.1 Contractor may not remove or disturb, or cause to be removed or disturbed, any historical, archaeological, architectural, or other cultural artifacts, relics, vestiges, remains, or objects of antiquity. If Contractor discovers one of these items, Contractor shall immediately notify City Engineer and further comply with the requirements of 13 Tex. Admin. Code Chs. 25 and 26 (2002), or successor regulation. Contractor shall protect site and cultural resources from further disturbance until professional examination can be made or until clearance to proceed is authorized in writing by City Engineer.

3.19.2 Should either threatened or endangered plant or animal species be encountered,

Contractor shall cease work immediately in the area of encounter and notify City Engineer.

3.20 *CUTTING AND PATCHING*

3.20.1 Contractor is responsible for necessary cutting, fitting, and patching to accomplish the Work and shall suitably support, anchor, attach, match, and trim or seal materials to work of other contractors. Contractor shall coordinate the Work with work of other contractors to minimize conflicts, as provided in Article 6.

3.20.2 Contractor may not endanger work by cutting, digging, or other action, and may not cut or alter work of other contractors except by written consent of City Engineer and affected contractor.

3.21 *CLEANING*

3.21.1 Contractor shall perform daily cleanup of all dirt, debris, scrap materials and other disposable items resulting from Contractor's operations, whether on-site or off-site. Unless otherwise authorized in writing by City Engineer, Contractor shall keep all streets, access streets, driveways, areas of public access, walkways, and other designated areas clean and open at all times.

3.21.2 Failure of Contractor to maintain a clean site, including access streets, is the basis for City Engineer to issue a Notice of Noncompliance. Should compliance not be attained within the time period in the Notice of Noncompliance, City Engineer may authorize necessary cleanup to be performed by others and the cost of the cleanup will be deducted from monies due Contractor.

Contractor shall legally dispose off-site, all waste materials and other excess materials resulting from Contractor's operations.

3.22 *SANITATION*

3.22.1 Contractor shall provide and maintain sanitary facilities at site for use of all construction forces under the Contract. Newly-constructed or existing sanitary facilities may not be used by Contractor.

3.23 *ACCESS TO WORK AND TO INFORMATION*

3.23.1 Contractor shall provide the City, Design Consultant, testing laboratories, and governmental agencies which have jurisdictional interests, access to the Work in preparation and in

progress wherever located. Contractor shall provide proper and safe conditions for the access.

3.23.2 If required by City Engineer, Contractor shall furnish information concerning character of Products and progress and manner of the Work, including information necessary to determine cost of the Work, such as number of employees, pay of employees, and time employees worked on various classes of the Work.

3.24 *TRADE SECRETS*

3.24.1 Contractor will not make any claim of ownership of trade secrets as to products used in the Work, or preparation of any mixture for the Work. City Engineer will at all times have the right to demand and Contractor shall furnish information concerning materials or samples of ingredients of any materials used, or proposed to be used, in preparation of concrete placed or other work to be done. Mixtures, once agreed on, shall not be changed in any manner without knowledge and consent of City Engineer. The City will make its best efforts to protect confidentiality of proprietary information.

3.25 *INDEMNIFICATION*

3.25.1 CONTRACTOR AGREES TO AND SHALL DEFEND, INDEMNIFY, AND HOLD THE CITY, ITS AGENTS, EMPLOYEES, OFFICERS, AND LEGAL REPRESENTATIVES (COLLECTIVELY THE "CITY") HARMLESS FOR ALL CLAIMS, CAUSES OF ACTION, LIABILITIES, FINES, AND EXPENSES (INCLUDING, WITHOUT LIMITATION, ATTORNEYS' FEES, COURT COSTS, AND ALL OTHER DEFENSE COSTS AND INTEREST) FOR INJURY, DEATH, DAMAGE, OR LOSS TO PERSONS OR PROPERTY SUSTAINED IN CONNECTION WITH OR INCIDENTAL TO PERFORMANCE UNDER THE CONTRACT INCLUDING, WITHOUT LIMITATION, THOSE CAUSED BY:

- .1 CONTRACTOR'S AND/OR ITS AGENTS', EMPLOYEES', OFFICERS', DIRECTORS', CONTRACTORS', OR SUBCONTRACTORS' (COLLECTIVELY IN NUMBERED SUBPARAGRAPHS .1 through .3, "CONTRACTOR") ACTUAL OR ALLEGED NEGLIGENCE OR INTENTIONAL ACTS OR OMISSIONS;
- .2 THE CITY'S AND CONTRACTOR'S ACTUAL OR ALLEGED CONCURRENT NEGLIGENCE, WHETHER CONTRACTOR IS IMMUNE FROM LIABILITY OR NOT;

- .3 THE CITY'S AND CONTRACTOR'S ACTUAL OR ALLEGED STRICT PRODUCTS LIABILITY OR STRICT STATUTORY LIABILITY, WHETHER CONTRACTOR IS IMMUNE FROM LIABILITY OR NOT.

CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD THE CITY HARMLESS DURING THE TERM OF THE CONTRACT AND FOR FOUR YEARS AFTER THE CONTRACT TERMINATES. CONTRACTOR SHALL NOT INDEMNIFY THE CITY FOR THE CITY'S SOLE NEGLIGENCE.

3.25.2 NOTWITHSTANDING ANYTHING TO THE CONTRARY, THE LIABILITY OF CONTRACTOR FOR THE CITY'S CONCURRENT NEGLIGENCE SHALL NOT EXCEED \$1,000,000.

3.26 *RELEASE AND INDEMNIFICATION – PATENT, COPYRIGHT, TRADEMARK, AND TRADE SECRET INFRINGEMENT*

3.26.1 UNLESS OTHERWISE SPECIFICALLY REQUIRED BY THE CONTRACT, CONTRACTOR AGREES TO AND SHALL RELEASE AND DEFEND, INDEMNIFY, AND HOLD HARMLESS THE CITY, ITS AGENTS, EMPLOYEES, OFFICERS, AND LEGAL REPRESENTATIVES (COLLECTIVELY THE "CITY") FROM ALL CLAIMS OR CAUSES OF ACTION BROUGHT AGAINST THE CITY BY ANY PARTY, INCLUDING CONTRACTOR, ALLEGING THAT THE CITY'S USE OF ANY EQUIPMENT, SOFTWARE, PROCESS, OR DOCUMENTS CONTRACTOR FURNISHES DURING THE TERM OF THE CONTRACT INFRINGES ON A PATENT, COPYRIGHT, OR TRADEMARK, OR MISAPPROPRIATES A TRADE SECRET. CONTRACTOR SHALL PAY ALL COSTS (INCLUDING, WITHOUT LIMITATION, ATTORNEYS' FEES, COURT COSTS, AND ALL OTHER DEFENSE COSTS, AND INTEREST) AND DAMAGES AWARDED.

3.26.2 CONTRACTOR SHALL NOT SETTLE ANY CLAIM ON TERMS WHICH PREVENT THE CITY FROM USING THE EQUIPMENT, SOFTWARE, PROCESS, OR PRODUCT WITHOUT THE CITY ENGINEER'S PRIOR WRITTEN CONSENT.

3.26.3 UNLESS OTHERWISE SPECIFICALLY REQUIRED BY THE CONTRACT, WITHIN 60 DAYS AFTER BEING NOTIFIED OF THE CLAIM, CONTRACTOR SHALL, AT ITS OWN EXPENSE, EITHER:

- .1 OBTAIN FOR THE CITY THE RIGHT TO CONTINUE USING THE EQUIPMENT, SOFTWARE, PROCESS, OR PRODUCT, OR
- .2 IF BOTH PARTIES AGREE, REPLACE OR MODIFY THEM WITH COMPATIBLE AND FUNCTIONALLY EQUIVALENT PRODUCTS.

IF NONE OF THESE ALTERNATIVES IS REASONABLY AVAILABLE, THE CITY MAY RETURN THE EQUIPMENT, SOFTWARE, OR PRODUCT, OR DISCONTINUE THE PROCESS, AND CONTRACTOR SHALL REFUND THE PURCHASE PRICE.

3.27 *INDEMNIFICATION PROCEDURES*

3.27.1 *Notice of Indemnification Claims:* If the City or Contractor receives notice of any claim or circumstances which could give rise to an indemnified loss, the receiving party shall give written notice to the other Party within 10 days. The notice must include the following:

- .1 a description of the indemnification event in reasonable detail,
- .2 the basis on which indemnification may be due, and
- .3 the anticipated amount of the indemnified loss.

This notice does not estop or prevent the City from later asserting a different basis for indemnification or a different amount of indemnified loss than that indicated in the initial notice. If the City does not provide this notice within the 10-day period, it does not waive any right to indemnification except to the extent that Contractor is prejudiced, suffers loss, or incurs expense because of the delay.

3.27.2 *Defense of Indemnification Claims:*

- .1 *Assumption of Defense:* Contractor may assume the defense of the claim at its own expense with counsel chosen by it that is reasonably satisfactory to the City. Contractor shall then control the defense and any negotiations to settle the claim. Within 10 days after receiving written notice of the indemnification request, Contractor must advise the City as to whether or not it will defend the claim. If Contractor does not assume the defense, the City shall assume and control the defense, and all defense expenses constitute an indemnified loss.

- .2 *Continued Participation:* If Contractor elects to defend the claim, the City may

retain separate counsel to participate in, but not control, the defense and to participate in, but not control, any settlement negotiations. Contractor may settle the claim without the consent or agreement of the City, unless it:

- .1 would result in injunctive relief or other equitable remedies or otherwise require the City to comply with restrictions or limitations that adversely affect the City;
- .2 would require the City to pay amounts that Contractor does not fund in full; or
- .3 would not result in the City's full and complete release from all liability to the plaintiffs or claimants who are parties to or otherwise bound by the settlement.

3.28 CONTRACTOR DEBT

IF CONTRACTOR, AT ANY TIME DURING THE TERM OF THIS AGREEMENT, INCURS A DEBT, AS THE WORD IS DEFINED IN SECTION 15-122 OF THE HOUSTON CITY CODE OF ORDINANCES, IT SHALL IMMEDIATELY NOTIFY CITY CONTROLLER IN WRITING. IF CITY CONTROLLER BECOMES AWARE THAT CONTRACTOR HAS INCURRED A DEBT, IT SHALL IMMEDIATELY NOTIFY CONTRACTOR IN WRITING. IF CONTRACTOR DOES NOT PAY THE DEBT WITHIN 30 DAYS OF EITHER SUCH NOTIFICATION, CITY CONTROLLER MAY DEDUCT FUNDS IN AN AMOUNT EQUAL TO THE DEBT FROM ANY PAYMENTS OWED TO CONTRACTOR UNDER THIS AGREEMENT, AND CONTRACTOR WAIVES ANY RECOURSE THEREFOR. CONTRACTOR SHALL FILE A NEW AFFIDAVIT OF OWNERSHIP, USING THE FORM DESIGNATED BY CITY, BETWEEN FEBRUARY 1 AND MARCH 1 OF EVERY YEAR DURING THE TERM OF THE CONTRACT.

ARTICLE 4 - ADMINISTRATION OF THE CONTRACT

4.1 CONTRACT ADMINISTRATION

4.1.1 City Engineer will provide administration of the Contract and City Engineer is authorized to issue Change Orders, Work Change Directives, and Minor Changes in the Work.

4.1.2 City Engineer may act through Project Manager, Design Consultant, or Inspector. When the term "City Engineer" is used in the Contract, action by City Engineer is required unless City Engineer delegates his authority in writing. The City Engineer may not delegate authority to render decisions under Section 4.4.

The City does not have control over or charge of, and is not responsible for, supervision, construction, and safety procedures enumerated in Section 3.3. The City does not have control over or charge of and is not responsible for acts or omissions of Contractor, Subcontractors, or Suppliers.

4.1.3 The City and Design Consultant may attend project meetings and visit the site to observe progress and quality of the Work. The City and Design Consultant are not required to make exhaustive or continuous on-site inspections to check quality or quantity of the Work.

4.1.4 Project Manager will review and approve or take other appropriate action on Contractor's submittals, but only for limited purpose of checking for conformance with information given and design concept expressed in the Contract.

4.1.5 Project Manager's review of the submittals is not conducted for purpose of determining accuracy and completeness of other details, such as dimensions and quantities, or for substantiating instructions for installation or performance of Products, all of which remain the responsibility of Contractor.

4.1.6 Project Manager's review of submittals does not relieve Contractor of its obligations under Sections 3.3, 3.12, and 3.18. Review does not constitute approval of safety precautions or, unless otherwise specifically stated by Project Manager in writing, of construction means, methods, techniques, sequences, or procedures. Project Manager's review of a specific item does not indicate approval of an assembly of which the item is a component.

4.1.7 Based on field observations and evaluations, Project Manager will process Contractor's progress payments, certify amounts due Contractor, and issue Certificates for Payment in the amount certified.

4.1.8 Project Manager will receive and forward to City Engineer for his review and records, written warranties and related documents required by the Contract and assembled by Contractor.

4.1.9 Upon written request by Contractor or Project Manager, City Engineer will resolve matters

of interpretation of or performance of the Contract, which are not Claims. City Engineer's decisions are final and binding on the Parties.

4.1.10 City Engineer may reject work which does not conform to the Contract.

4.1.11 When City Engineer considers it necessary to implement the intent of the Contract, City Engineer may require additional inspection or testing of work in accordance with Paragraphs 13.6.3 and 13.6.4, whether such work is fabricated, Installed, or completed.

4.2 *COMMUNICATIONS IN ADMINISTRATION OF THE CONTRACT*

4.2.1 Except as otherwise provided in the Contract or when authorized by City Engineer in writing, Contractor shall communicate with Project Manager. Contractor shall communicate with Design Consultant, Design Consultant's subconsultants, and separate contractors through Project Manager. The City will communicate with Subcontractors and Suppliers through Contractor.

4.3 *CLAIMS AND DISPUTES*

4.3.1 *Documentation by Project Manager:* Contractor shall submit Claims, including those alleging an error or omission by Project Manager or Design Consultant, to Project Manager for documentation and recommendation to City Engineer.

4.3.2 *Decision of City Engineer:* Upon submission of Claim by Project Manager or Contractor, City Engineer will resolve Claims in accordance with Section 4.4.

4.3.3 *Time Limits on Claims:* Claims by Contractor must be made within 90 days after occurrence of event giving rise to the Claim.

4.3.4 *Continuing the Contract Performance:* Pending final resolution of a Claim including referral to non-binding mediation, unless otherwise agreed in writing, Contractor shall proceed diligently with the performance of the Contract and the City will continue to make payments in accordance with the Contract.

4.3.4.1 Pending final resolution of a Claim including referral to non-binding mediation,

Contractor is responsible for safety and protection of physical properties and conditions at site.

4.3.5 *Claims for Concealed or Unknown Conditions:* Concealed or unknown physical conditions include utility lines, other man-made structures, storage facilities, Pollutants and Pollutant Facilities, and the like, but do not include conditions arising from Contractor operations, or failure of Contractor to properly protect and safeguard subsurface facilities. Concealed conditions also include naturally-occurring soil conditions outside the range of soil conditions identified through geotechnical investigations, but do not include conditions arising from groundwater, rain, or flood.

4.3.5.1 If conditions are encountered at the site which are Underground Facilities or otherwise concealed or unknown conditions which differ materially from:

- .1 those indicated by the Contract; or
- .2 conditions which Contractor could have discovered through site inspection, geotechnical testing, or otherwise;

then Contractor will give written notice to City Engineer no later than five days after Contractor's first observation of the condition and before condition is disturbed. Contractor's failure to provide notice constitutes a waiver of a Claim.

4.3.5.2 City Engineer will promptly investigate concealed or unknown conditions. If City Engineer determines that conditions at the site are not materially different and that no change in Contract Price or Contract Time is justified, City Engineer will notify Contractor in writing, stating reasons. If City Engineer determines the conditions differ materially and cause increase or decrease in Contractor's cost or time required for performance of part of the Work, City Engineer will recommend an adjustment in Contract Price or Contract Time, or both, as provided in Article 7. Opposition by a Party to the City Engineer's determination must be made within 21 days after City Engineer has given notice of the decision. If the Parties cannot agree on adjustment to Contract Price or Contract Time, adjustment is subject to further proceedings pursuant to Section 4.4.

4.3.6 *Claims for Additional Cost:* If Contractor wishes to make a Claim for increase in Contract Price, Contractor shall give written notice before proceeding with work for which Contractor intends to submit a Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

4.3.6.1 Contractor may file a Claim in accordance with Section 4.4 if Contractor believes it has incurred additional costs, for the following reasons:

- .1 written interpretation of City Engineer;
- .2 order by City Engineer to stop the Work when Contractor is not at fault;
- .3 suspension of the Work by City Engineer;
- .4 termination of the Contract by City Engineer; or
- .5 The City's non-compliance with another provision of the Contract.

4.3.6.2 No increase in Contract Price is allowed for delays or hindrances to the Work, except for direct and unavoidable extra costs to Contractor caused by failure of the City to provide information and services, or to make land and materials available, when required of the City under the Contract. Any increase claimed is subject to the provisions of Section 4.4 and Article 7.

4.3.6.3 The City is not liable for Claims for delay when Date of Substantial Completion occurs prior to expiration of Contract Time.

4.3.7 *Claims for Additional Time:* If Contractor wishes to make a Claim for an increase in Contract Time, Contractor shall give written notice as provided in Section 8.2. In case of continuing delay, only one Claim is necessary.

4.4 *RESOLUTION OF CLAIMS AND DISPUTES*

4.4.1 City Engineer will review Claims and take one or more of the following preliminary actions within 30 days of receipt of Claim:

- .1 submit a suggested time to meet and discuss the Claim with City Engineer;
- .2 reject Claim, in whole or in part, stating reasons for rejection;
- .3 recommend approval of the Claim by the other Party;
- .4 suggest a compromise; or
- .5 take other actions as City Engineer deems appropriate to resolve the Claim.

4.4.2 City Engineer may request additional supporting data from claimant. Party making Claim shall, within 10 days after receipt of City Engineer's request, submit additional supporting data requested by City Engineer.

4.4.3 At any time prior to rendering a written decision regarding a Claim, City Engineer may refer Claim to non-binding mediation. If Claim is resolved, City Engineer will prepare and obtain all appropriate documentation. If Claim is not resolved, City Engineer will take receipt of Claim and begin a new review under Section 4.4.

4.4.4 If Claim is not referred to or settled in non-binding mediation, City Engineer may conduct a hearing and will render a written decision, including findings of fact, within 75 days of receipt of Claim, or a time mutually agreed upon by the Parties in writing. City Engineer may notify Surety and request Surety's assistance in resolving Claim. City Engineer's decision is final and binding on the Parties.

4.5 *CONDITION PRECEDENT TO SUIT; WAIVER OF ATTORNEY FEES AND INTEREST*

4.5.1 Neither the City nor Contractor may recover attorney fees for any claim brought in connection with this Contract.

4.5.2 Neither the City nor the Contractor may recover interest for any damages claim brought in connection with this Contract except as allowed by TEXAS LOCAL GOVERNMENT CODE Chapter 2251.

4.6 *INTERIM PAYMENT WAIVER & RELEASE*

4.6.1 In accordance with section 4.3, the Contractor shall use due diligence in the discovery and submission of any Claim against the City related to the Contractor's work.

4.6.2 The Contractor shall submit any Claim to the City not later than the 90th day after the occurrence of the event giving rise to the Claim.

4.6.3 Any failure to timely comply with the requirements of section 4.6.2 waives and releases any Claim when the Contractor submits an application for payment after the 90th day.

4.6.4 This waiver does not cover any retainage. In case of any conflict of law, this language shall be revised to the minimum extent necessary to avoid legal conflict. This waiver is made specifically for the benefit of the City.

ARTICLE 5 - SUBCONTRACTORS AND
SUPPLIERS

5.1 *AWARD OF SUBCONTRACTS
OTHER CONTRACTS FOR
PORTIONS OF THE WORK*

5.1.1 Contractor may not contract with a Subcontractor, Supplier, person, or entity that City Engineer has made a reasonable and timely objection to.

5.1.2 If City Engineer has a reasonable objection to person or entity proposed by Contractor, Contractor shall propose another with whom City Engineer has no reasonable objection.

5.1.3 Contractor shall execute contracts with approved Subcontractors, Suppliers, persons, or entities before the Subcontractors or Suppliers begin work under the Contract. All such contracts must be executed and sent to the OBO Director and Contracting Department within 30 days after the date of the Notice to Proceed and must include provisions set forth in Articles 3 and 5 of this Document.

5.1.4 Contractor shall notify City Engineer in writing of any proposed change of Subcontractor, Supplier, person, or entity previously accepted by the City.

5.1.5 Contractor shall make timely payments to Subcontractors and Suppliers for performance of the Contract. Contractor shall protect, defend, and indemnify the City from any claim or liability arising out of Contractor's failure to make the payments. Disputes relating to payment of Business Enterprise Subcontractors or Suppliers will be submitted to arbitration in same manner as other disputes under Business Enterprise subcontracts. Failure of Contractor to comply with decisions of arbitrator may be determined by City Engineer a material breach leading to termination of the Contract.

5.2 *CONTRACTOR RESPONSIBILITY
FOR SUBCONTRACTORS*

5.2.1 Contractor is responsible to the City, as may be required by laws and regulations, for all acts and omissions of Subcontractors, Suppliers, and other persons and organizations performing or furnishing any of the Work under direct or indirect contract with Contractor.

5.2.2 Contractor shall make available to each proposed Subcontractor, prior to execution of subcontract, copies of the Contract to which

Subcontractor is bound by this Section 5.2. Contractor shall notify Subcontractor of any terms of proposed subcontract which may be at variance with the Contract.

5.2.3 The City's approval of Subcontractor or Suppliers does not relieve Contractor of its obligation to perform, or to have performed to the full satisfaction of the City, the Work required by the Contract.

5.2.4 Unless there is a contractual relationship between Contractor and a Subcontractor or Supplier to the contrary, Contractor shall withhold no more retainage from Subcontractors or Suppliers than City withholds from Contractor under this Agreement. However, once a Subcontractor or Supplier completes performance, Contractor shall release all retainage to that Subcontractor or Supplier regardless if City continues to retain under this Agreement.

5.2.5 Prior to a Subcontractor or Supplier commencing performance for Contractor, Contractor shall meet with that Subcontractor or Supplier to provide instructions on invoicing procedures, dispute resolution procedures, and statutory rights, such as claim filing procedures under the McGregor Act. Subcontractors and Suppliers must certify to the City Engineer that Contractor has fulfilled the requirements of this Section.

ARTICLE 6 - CONSTRUCTION BY THE CITY OR
BY SEPARATE CONTRACTORS

6.1 *THE CITY'S RIGHT TO PERFORM
CONSTRUCTION AND TO AWARD
SEPARATE CONTRACTS*

6.1.1 The City may perform on-site construction operations related to the Work and as part of the Project with the City's workforce or with separate contractors.

6.2 *COORDINATION*

6.2.1 The City will coordinate activities of the City's workforce and of each separate contractor with work of Contractor, and Contractor shall cooperate with the City and separate contractors.

6.2.1.1 Contractor shall participate with other separate contractors and the City in reviewing their construction schedules when directed to do so by the Project Manager. Contractor shall make revisions to construction schedule and Contract Price deemed

necessary after joint review and mutual agreement. Construction schedules shall then constitute schedules to be used by Contractor, separate contractors, and the City, until subsequently revised.

6.2.2 Contractor shall afford to the City and to separate contractors reasonable opportunity for introduction and storage of their materials and equipment, and for performance of their activities.

6.2.3 If part of Contractor's work depends on proper execution of construction or operations by the City or a separate contractor, Contractor shall, prior to proceeding with that portion of the Work, inspect the other work and promptly report to City Engineer apparent discrepancies or defects in the other construction that would render it unsuitable for the proper execution of the Work. Failure of Contractor to report apparent discrepancies or defects in the other construction shall constitute acknowledgment that the City's or separate contractor's completed or partially completed construction is fit and proper to receive Contractor's work, except as to discrepancies or defects not then reasonably discoverable.

6.3 *MUTUAL RESPONSIBILITY*

6.3.1 The responsible party bears the costs caused by delays, by improperly timed activities, or by nonconforming construction.

6.3.2 Contractor shall promptly remedy damage caused by Contractor to completed or partially completed construction or to property of the City or separate contractor.

6.3.3 Claims or disputes between Contractor and other City contractors, or subcontractors of other City contractors, working on the Project must be submitted to binding arbitration in accordance with Construction Industry Arbitration Rules of the American Arbitration Association upon demand by any party to the dispute or by the City.

6.4 *THE CITY'S RIGHT TO CLEAN UP*

6.4.1 If dispute arises among Contractor, separate contractors, and the City as to responsibility under their respective contracts for maintaining premises and surrounding area free from waste materials and rubbish as described in Section 3.21, the City may clean up and allocate cost among those responsible, as determined by City Engineer.

ARTICLE 7 - CHANGES IN THE WORK

7.1 *CHANGES*

7.1.1 Changes in scope of the Work, subject to limitations in Article 7 and elsewhere in the Contract, may be accomplished without invalidating the Contract, or without notifying Surety by:

- .1 Change Order;
- .2 Work Change Directive; or
- .3 Minor Change in the Work.

7.1.2 The following types of Change Orders require City Council approval:

- .1 a single Change Order that exceeds five percent of Original Contract Price,
 - .2 a Change Order which, when added to previous Change Orders, exceeds five percent of Original Contract Price,
 - .3 a Change Order, in which the total value of increases outside of the general scope of work approved by City Council, when added to increases outside the general scope of work approved by City Council in previous Change Orders, exceeds 40 percent of the Original Contract Price, even if the net increase to the Original Contract Price is five percent or less.
- In this context, "increase" means an increase in quantity resulting from the addition of locations not within the scope of work approved by City Council, or the addition of types of goods or services not bid as unit price items.

Nothing in this Section is intended to permit an increase of the Contract Price in excess of the limit set out in TEX. LOC. GOV'T CODE ANN. §252.048 or its successor statute.

7.1.3 Contractor shall proceed promptly to execute changes in the Work provided in Modifications, unless otherwise stated in the Modification.

7.2 *WORK CHANGE DIRECTIVES*

7.2.1 A Work Change Directive cannot change Contract Price or Contract Time, but is evidence that the Parties agree that a change, ordered by directive, will be incorporated in a subsequently issued Change Order as to its effect, if any, on Contract Price or Contract Time.

7.2.2 Failure by Contractor to commence work identified in a Work Change Directive within the time specified by City Engineer, or to complete the

work in a reasonable period of time, may be determined by City Engineer to be a material breach of Contract.

7.2.3 A Work Change Directive is used in the absence of total agreement of the terms of a Change Order. Interim payments are made in accordance with Paragraph 9.6.1.

7.2.4 If Contractor signs a Work Change Directive, then Contractor agrees to its terms including adjustment in Contract Price and Contract Time or method for determining them. Agreement by the Parties to adjustments in Contract Price and Contract Time are immediately recorded as a Change Order.

7.2.5 City Engineer, by Work Change Directive, may direct Contractor to take measures as necessary to expedite construction to achieve Date of Substantial Completion on or before expiration of Contract Time. When the Work is expedited solely for convenience of the City and not due to Contractor's failure to prosecute timely completion of the Work, then Contractor is entitled to an adjustment in Contract Price equal to actual costs determined in accordance with Article 7.

7.3 *ADJUSTMENTS IN CONTRACT PRICE*

7.3.1 Adjustments in Contract Price are accomplished by Change Order and are based on one of the following methods:

- .1 mutual acceptance of fixed price, properly itemized and supported by sufficient data to permit evaluation;
- .2 unit prices stated in the Contract or subsequently agreed upon;
- .3 cost to be determined in a manner agreed upon by the Parties and mutually acceptable fixed or percentage fee; or
- .4 as provided in Paragraph 7.3.2.

7.3.2 If Contractor does not agree with a change in Contract Price or Contract Time or the method for adjusting them specified in the Work Change Directive within 21 days from date of the Work Change Directive's issuance, method and adjustment are determined by City Engineer. If Project Manager or Contractor disagree with City Engineer's determination they then may file a Claim in accordance with Section 4.4.

7.3.2.1 If City Engineer determines a method and adjustment in Contract Price under Paragraph

7.3.2, Contractor shall provide, in a form as City Engineer may prescribe, appropriate supporting data for items submitted under Paragraph 7.3.2. Failure to submit the data within 21 days of request for the data by City Engineer shall constitute waiver of a Claim.

7.3.2.2 Unless otherwise provided in the Contract, costs for the purposes of this Paragraph 7.3.2 are limited to the following:

- .1 costs of labor, including labor burden as stated below for social security, unemployment insurance, customary and usual fringe benefits required by agreement or custom, and Workers' Compensation insurance;
 - .1 the maximum labor burden applied to costs of labor for changes in the Work is 55 percent;
- .2 costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 rental costs of machinery and equipment, exclusive of hand tools, whether rented from Contractor or others, with prior approval of City Engineer;
- .4 costs of premiums for Bonds and insurance and permit fees related to the change in the Work;
- .5 additional costs of direct supervision of work and field office personnel directly attributable to the change; and
- .6 allowances for overhead and profit as stated below.
 - .1 the maximum allowances for overhead and profit on increases due to Change Orders:
 - .2 for changes in the Work performed by Contractor and Subcontractors, allowance for overhead and profit are applied to an amount equal to cost of all additions less cost of all deletions to the Work. Allowance for overhead to Contractor and first tier Subcontractors on changes performed by Subcontractors are applied to an amount equal to the sum of all increases to the Work by applicable Subcontractors.

	<u>Overhead</u>	<u>Profit</u>
to Contractor for change in the Work performed by Subcontractors:	10 percent	0 percent
to first tier Subcontractors for change in the Work performed by its Subcontractors:	10 percent	0 percent
to Contractor and Subcontractor for change in the Work performed by their respective firms:	10 percent	5 percent

7.3.3 If the City deletes or makes a change, which results in a net decrease in Contract Price, the City is entitled to a credit calculated in accordance with Paragraphs 7.3.1 and 7.3.2 and Subparagraphs 7.3.2.1, and 7.3.2.2.1 through 7.3.2.2.5. When both additions and credits covering related work or substitutions are involved in a change, allowance for overhead and profit is figured on the basis of a net increase, if any, with respect to that change in accordance with Subparagraph 7.3.2.2.6.

7.3.4 When Contractor agrees with the determination made by City Engineer concerning adjustments in Contract Price and Contract Time, or the Parties otherwise reach agreement upon the adjustments, the agreement will be immediately recorded by Change Order.

7.4 MINOR CHANGES IN THE WORK

7.4.1 A Minor Change in Work is binding on the Parties. Contractor shall acknowledge, in a written form acceptable to City Engineer, that there is no change in Contract Time or Contract Price and shall carry out the written orders promptly.

ARTICLE 8 - TIME

8.1 PROGRESS AND COMPLETION

8.1.1 Time is of the essence in the Contract. By executing the Contract, Contractor agrees that Contract Time is a reasonable period for performing the Work.

8.1.2 *Computation of Time:* In computing any period of time prescribed or allowed by the General Conditions, the day of the act, event, or default after which designated period of time begins to run is not to be included. Last day of the period so

computed is to be included, unless it is a Sunday or Legal Holiday, in which event the period runs until end of next day which is not a Sunday or Legal Holiday. Sundays and Legal Holidays are considered to be days and are to be included in all other time computations relative to Contract Time.

8.1.3 Contractor may not commence the Work prior to the effective date of insurance and Bonds required by Article 11.

8.1.4 Contractor shall proceed expeditiously and without interruption, with adequate forces, and shall achieve Date of Substantial Completion within Contract Time.

8.1.5 Should progress of the Work fall behind construction schedule, except for reasons stated in Paragraph 8.2.1, Contractor shall promptly submit at the request of Project Manager, updated construction schedule to City Engineer for approval. Contractor's failure to submit updated schedule may, at City Engineer's discretion, constitute a material breach of the Contract. Contractor shall take action necessary to restore progress by working the hours, including night shifts and lawful overtime operations as necessary, to achieve Date of Substantial Completion within Contract Time.

8.1.6 Except in connection with safety or protection of persons or the Work or property at the site or adjacent to the site, and except as otherwise indicated in the Contract, all the Work at the site will be performed Monday through Saturday between the hours of 7:00 a.m. and 7:00 p.m. Contractor may not perform work between 7:00 p.m. and 7:00 a.m., on a Sunday, or on a Legal Holiday, without giving City Engineer 24-hour prior written notice and receiving written consent of City Engineer.

8.2 DELAYS AND EXTENSIONS OF TIME

8.2.1 Contractor may request extension of Contract Time for a delay in performance of work that arises from causes beyond control and without fault or negligence of Contractor. Examples of these causes are:

- .1 acts of God or of the public enemy;
- .2 acts of government in its sovereign capacity;
- .3 fires;
- .4 floods;
- .5 epidemics;
- .6 quarantine restrictions;
- .7 strikes;
- .8 freight embargoes;
- .9 unusually severe weather; and
- .10 discovery of Pollutants or Pollutant Facilities at the site.

8.2.2 For any reason other than those listed in Section 4.3.6.2, if the Contractor's work is delayed in any manner or respect, the Contractor shall have no claim for damages and shall have no right of additional compensation from the City by reason of any delay or increased expense to the Contractor's work, except for an extension of time as provided in this provision.

8.2.3 Contractor may request an extension of Contract Time for delay only if:

- .1 delay is caused by failure of Subcontractor or Supplier to perform or make progress; and
- .2 cause of failure is beyond control of both Contractor and Subcontractor or Supplier.

8.2.4 Claims relating to Contract Time must be made in accordance with Paragraph 4.3.7.

8.2.5 Claims for extending or shortening Contract Time are based on written notice promptly delivered by the Party making Claim to other Party. Claim must accurately describe occurrence generating Claim, and a statement of probable effect on progress of the Work.

8.2.6 Claims for extension of Contract Time are considered only when a Claim is filed within the time limits stated in Paragraph 4.3.3.

- .1 Notwithstanding paragraph 4.3.3, an extension of time for delays under this paragraph may be granted only upon written application by the Contractor within 48 hours from the claimed delay.

8.2.7 Written notice of Claim must be accompanied by claimant's written statement that adjustment claimed is entire adjustment to which claimant is entitled as a result of the occurrence of the event. When the Parties cannot agree, Claims for adjustment in Contract Time are determined by City Engineer in accordance with Section 4.4.

8.2.8 Adjustments to Contract Time are accomplished by Change Order.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.1 *UNIT PRICE WORK*

9.1.1 Where the Contract provides that all or part of the Work is based on Unit Prices, the Original

Contract Price includes, for all Unit Price work, an amount equal to the sum of Unit Prices times Unit Price Quantities for each separately identified item of Unit Price work.

9.1.2 Each Unit Price includes an amount to cover Contractor's overhead and profit for each separately identified item.

9.1.3 The Contractor may not make a Claim against the City for excess or deficiency in Unit Price Quantities provided in the Contract, except as provided in Subparagraph 9.1.4. Payment at the prices stated in the Contract is in full for the completed work. Contractor is not entitled to additional payment for materials, supplies, labor, tools, machinery and all other expenditures incidental to satisfactory completion of the Work.

9.1.4 City Engineer may increase or decrease quantities of the Work within limitations stated in Paragraph 7.1.2. Contractor is entitled to payment for actual quantities of items provided at Unit Prices set forth in the Contract.

9.1.5 Where the final quantity of work performed by Contractor on Major Unit Price Work item differs by more than 25 percent from quantity of the item stated in the Contract, a Party may request an adjustment in Unit Price, for the portion that differs by more than 25 percent, by a Change Order under Section 7.3.

9.2 *ESTIMATES FOR PAYMENT, UNIT PRICE WORK*

9.2.1 Following the day of each month indicated in the Contract, Project Manager will prepare a Certificate for Payment for the preceding monthly period based on estimated units of work completed. Prior to preparing Certificate of Payment, Contractor shall have submitted to City Engineer on a form approved by the Director of the Mayor's Office of Business Opportunity, evidence satisfactory to the City Engineer of payments made to Subcontractors and Suppliers for the month preceding the month for which the Certificate for Payment is prepared.

9.2.2 Before final completion, City Engineer will review and confirm with Contractor the actual final installed Unit Price quantities. City Engineer's determination of actual final installed Unit Price quantities will be included in the final Certificate for Payment and any previous underpayments and overpayments will be reconciled with the actual final Unit Price quantities. Contractor shall file written notice of intent to appeal, if any, City Engineer's

determination within 10 days of receipt of final Certificate for Payment. Upon expiration of the 10-day period, City Engineer's decision is final and binding on the Parties. If Contractor submits notice within the 10-day period, Contractor shall submit a Claim in accordance with Section 4.4.

9.3 *STIPULATED PRICE WORK*

9.3.1 For work contracted on a Stipulated Price basis, 10 days before submittal of first Application for Payment, Contractor shall submit to City Engineer a Schedule of Values allocated to various portions of the Work, prepared in the form and supported by the data as City Engineer may require to substantiate its accuracy. This schedule, as approved by City Engineer, is used as a basis for approval of Contractor's Applications for Payment.

9.4 *APPLICATIONS FOR PAYMENT, STIPULATED PRICE WORK*

9.4.1 For work contracted on a Stipulated Price basis, Contractor shall submit Applications for Payment to City Engineer each month on a form acceptable to City Engineer in accordance with Schedule of Values. Application must indicate percentages of completion of each portion of the Work listed in Schedule of Values as of the end of the period covered by the Application for Payment.

9.4.2 Applications for Payment must be supported by substantiating data as City Engineer may require and must reflect retainages as provided below. Evidence satisfactory to the City Engineer of payments made to Subcontractors and Suppliers for the month preceding the month for which the Application for Payment is submitted must accompany each Application for Payment on a form approved by the Director of Mayor's Office of Business Opportunity. Application must be sworn and notarized.

9.5 *CERTIFICATES FOR PAYMENT*

9.5.1 City Engineer will, within 10 days after the date specified in the Contract for Unit Price work, or upon receipt of Contractor's Application for Payment for Stipulated Price work, issue a Certificate for Payment for work based on amount which City Engineer determines is properly due, with copy to Contractor.

9.5.2 Unless otherwise provided in the Contract, payment for completed work and for properly stored Products is conditioned upon compliance with procedures satisfactory to City Engineer to protect the City's interests. Procedures

will include applicable insurance, storage, and transportation to site for materials and equipment stored off-site. Contractor is responsible for maintaining materials and equipment until Date of Substantial Completion.

9.5.3 Contractor shall document its use of Ultra Low Sulfur Diesel Fuel by providing invoices and receipts evidencing Contractor's use.

9.6 *COMPUTATIONS OF CERTIFICATES FOR PAYMENT*

9.6.1 Subject to the provisions of the Contract, the amount of each Certificate for Payment is calculated as follows:

- .1 that portion of Contract Price allocated to completed work as determined by:
 - .1 multiplying the percentage of completion of each portion of the Work listed in the Schedule of Values by the value of that portion of the Work, or
 - .2 multiplying Unit Price quantities Installed times the Unit Prices listed in the Contract;
- .2 plus progress payments for completed work that has been properly authorized by Modifications;
- .3 less retainage of five percent;
- .4 plus actual costs, properly substantiated by certified copies of invoices and freight bills, of non-perishable materials and equipment delivered and properly stored, if approved in advance by Project Manager, less 15 percent;
- .5 less any previous payments by the City.

9.7 *DECISIONS TO WITHHOLD CERTIFICATION*

9.7.1 City Engineer may decline to certify payment and may withhold payment in whole or in part to the extent reasonably necessary to protect the City if, in City Engineer's opinion, there is reason to believe that:

- .1 nonconforming work has not been remedied;
- .2 the Work cannot be completed for unpaid balance of Contract Price;
- .3 there is damage to the City or another contractor;
- .4 the Work will not be completed within Contract Time and that unpaid balance will not be adequate to cover actual and liquidated damages;

- .5 probable evidence that third party claims will be filed in court, in arbitration, or otherwise;
- .6 Contractor has failed to make payments to Subcontractors or Suppliers for labor, material, or equipment; or
- .7 Contractor has persistently failed to carry out work in accordance with the Contract.
- .8 Contractor has not paid Subcontractors or Suppliers because of a payment dispute; or
- .9 Contractor has failed to provide satisfactory evidence described in Paragraphs 9.2.1, 9.4.2, and 9.8.2.

9.7.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

9.7.3 City Engineer may decline to certify payment and may withhold request for payment in whole or in part upon failure of Contractor to submit initial construction schedule or monthly schedule updates, as required in Paragraphs 3.15.1 and 3.15.3.

9.8 *PROGRESS PAYMENTS*

9.8.1 The City will make payment, in an amount certified by City Engineer, within 20 days after City Engineer has issued a Certificate for Payment.

9.8.2 The City has no obligation to pay or to facilitate the payment to a Subcontractor or Supplier, except as may otherwise be required by law. Contractor shall comply with the prompt payment requirements of Chapter 2251 of the Government Code. State law requires payment of Subcontractors and Suppliers by Contractor within 7 calendar days of Contractor's receipt of payment from the City, unless there is a payment dispute between Contractor and a Subcontractor or Supplier evidenced on a form approved by the Director of Mayor's Office of Business Opportunity and submitted to the City Engineer each month with Application for Payment or Estimate for Payment.

CONTRACTOR SHALL DEFEND AND INDEMNIFY THE CITY FROM ANY CLAIMS OR LIABILITY ARISING OUT OF CONTRACTOR'S FAILURE TO MAKE THESE PAYMENTS.

9.8.2.1 The City may, upon request and at the discretion of City Engineer, furnish to Subcontractor information regarding percentages of completion or

the amounts applied for by Contractor, and action taken thereon by the City because of work done by the Subcontractor.

9.8.2.2 Contractor shall prepare and submit to City Engineer a Certification of Payment to Subcontractors and Suppliers form to be attached to each monthly Estimate for Payment or Application for Payment.

9.8.3 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Work by the City, does not constitute acceptance of work which is not in accordance with the Contract.

9.9 *DATE OF SUBSTANTIAL COMPLETION*

9.9.1 When Contractor considers the Work, or a portion thereof designated by City Engineer, to be substantially complete, Contractor shall prepare and submit to Project Manager a comprehensive punch list of items to be completed or corrected. Failure to include an item on the punch list does not alter the responsibility of Contractor to comply with the Contract.

9.9.1.1 By submitting the punch list to Project Manager, Contractor represents that work on the punch list will be completed within the time provided for in Subparagraph 9.9.4.3.

9.9.2 Upon receipt of Contractor's punch list, Project Manager will inspect the Work, or designated portion thereof, to verify that the punch list contains all items needing completion or correction. If Project Manager's inspection discloses items not on Contractor's punch list, the items must be added to the punch list of items to be completed or corrected. If Project Manager's inspection reveals that Contractor is not yet substantially complete, Contractor shall complete or correct the deficiencies and request another inspection by Project Manager. The City may recover the costs of re-inspection from Contractor.

9.9.3 Prior to City Engineer's issuing a Certificate of Substantial Completion, Contractor shall also provide:

- .1 Certificate of Occupancy for new construction, or Certificate of Compliance for remodeled work, as applicable, and
- .2 compliance with Texas Accessibility Standards through state inspection of the Work, if required. If Contractor calls for inspection in a timely manner

and the inspection is delayed through no fault of Contractor, and City Engineer so confirms, City Engineer may, upon request by Contractor, add the inspection to the punch list in Paragraph 9.9.2 and issue a Certificate of Substantial Completion.

9.9.4 When the Work, or designated portion thereof, is determined by City Engineer to be sufficiently complete in accordance with the Contract so the City can occupy or utilize the Work, or designated portion thereof, for the purpose for which it is intended, City Engineer will prepare a Certificate of Substantial Completion that incorporates the punch list in Paragraph 9.9.2 and establishes:

- .1 Date of Substantial Completion;
- .2 responsibilities of the Parties for security, maintenance, heating, ventilating and air conditioning, utilities, damage to the Work, and insurance; and
- .3 fixed time within which Contractor shall complete all items on punch list of items to be corrected accompanying the certificate.

9.9.5 Warranties required by the Contract shall commence on the Date of Substantial Completion unless otherwise provided by City Engineer in Certificate of Substantial Completion. Warranties may not commence on items not substantially completed.

9.9.6 After Date of Substantial Completion and upon application by Contractor and approval by City Engineer, the City may make payment, reflecting adjustment in retainage, if any, as follows:

- .1 with the consent of Surety, the City may increase payment to Contractor to 96 percent of Contract Price, less value of items to be completed and accrued liquidated damages.

9.9.7 Contractor shall complete or correct the items in Paragraph 9.9.2 within the time period set out in the Certificate of Substantial Completion. If Contractor fails to do so, the City may issue a Notice of Noncompliance and proceed according to Section 2.5.

9.10 *PARTIAL OCCUPANCY OR USE*

9.10.1 The City may occupy or use any completed or partially completed portion of the Work at any stage, provided the occupancy or use is consented to by Contractor and Contractor's insurer and authorized by public authorities having jurisdiction over the Work. Consent of Contractor to

partial occupancy or use may not be unreasonably withheld.

9.10.2 Immediately prior to the partial occupancy or use, Project Manager and Contractor shall jointly inspect the area to be occupied or portion of the Work to be used to determine and record condition of the Work.

9.10.3 Partial occupancy or use of a portion of the Work does not constitute acceptance of work not in compliance with requirements of the Contract.

9.11 *FINAL COMPLETION AND FINAL PAYMENT*

9.11.1 Contractor shall review the Contract and inspect the Work prior to Contractor notification to City Engineer that the Work is complete and ready for final inspection. Contractor shall submit affidavit that the Work has been inspected and that the Work is complete in accordance with requirements of the Contract.

9.11.2 Project Manager will make final inspection within 15 days after receipt of Contractor's written notice that the Work is ready for final inspection and acceptance. If Project Manager finds the Work has been completed in accordance with the Contract, Contractor shall submit items set out in Paragraph 9.11.4 and, for stipulated price contracts, a final Application for Payment. City Engineer will, within 10 days, issue Certificate of Final Completion stating that to the best of City Engineer's knowledge, information, and belief, the Work has been completed in accordance with the Contract, and will recommend acceptance of the Work by City Council.

9.11.3 Should work be found not in compliance with requirements of the Contract, City Engineer will notify Contractor in writing of items of noncompliance. Upon inspection and acceptance of the corrections by Project Manager, compliance with all procedures of Paragraph 9.11.2, and Contractor's submission of the items set out in Paragraph 9.11.4, the City Engineer will issue Certificate of Final Completion to Contractor as provided in Paragraph 9.11.2.

9.11.4 Contractor shall submit the following items to City Engineer before City Engineer will issue a Certificate of Final Completion:

- .1 affidavit that payrolls, invoices for materials and equipment, and other indebtedness of Contractor connected with the Work, less amounts withheld by the City, have been paid or otherwise satisfied. If required by City Engineer, Contractor shall submit

- further proof including waiver or release of lien or claims from laborers or Suppliers of Products;
- .2 certificate evidencing that insurance required by the Contract to remain in force after final payment is currently in effect, will not be canceled or materially changed until at least 30 days written notice has been given to the City;
 - .3 written statement that Contractor knows of no substantial reason that insurance will not be renewable to cover correction and warranty period required by the Contract;
 - .4 consent of Surety to final payment; and
 - .5 copies of record documents, maintenance manuals, tests, inspections, and approvals.

Upon City Engineer's issuance of a Certificate of Final Completion, Contractor may request increase in payment to 99 percent of Contract Price, less accrued liquidated damages.

9.11.5 If Contractor fails to submit required items in Paragraph 9.11.4 within 10 days of Project Manager's inspection of the Work under Paragraph 9.11.2 or Paragraph 9.11.3, City Engineer may, but is not obligated to:

- .1 deduct liquidated damages accrued from monies held;
- .2 proceed to City Council for acceptance of the Work, minus some or all of the items Contractor fails to submit under Paragraph 9.11.4; and,
- .3 upon acceptance by City Council of the portion of the Work completed, make final payment as set out in Paragraph 9.11.8.

9.11.6 If final completion is materially delayed through no fault of Contractor, or by issuance of Change Orders affecting date of final completion, and City Engineer so confirms, the City may, upon application by Contractor and certification by City Engineer, and without terminating the Contract, make payment of balance due for that portion of the Work fully completed and accepted.

9.11.7 If remaining balance due for work not corrected is less than retainage stipulated in the Contract, Contractor shall submit to City Engineer written consent of Surety to payment of balance due for that portion of the Work fully completed and accepted, prior to certification of the payment. The payment is made under terms governing final payment, except that it does not constitute waiver of Claims.

9.11.8 The City will make final payment to Contractor within 30 days after acceptance of the Work by City Council, subject to limitations, if any, as stated in the Contract.

9.11.9 Acceptance of final payment by Contractor shall constitute a waiver of all Claims, whether known or unknown, by Contractor, except those previously made in writing and identified by Contractor as unsettled at time of final Application for Payment.

9.12 *LIQUIDATED DAMAGES*

9.12.1 Contractor, Surety, and the City agree that failure to complete the Work within Contract Time will cause damages to the City and that actual damages from harm are difficult to estimate accurately. Therefore, Contractor, Surety, and the City agree that Contractor and Surety are liable for and shall pay to the City the amount stipulated in Supplementary Conditions as liquidated damages, and that the amount of damages fixed therein is a reasonable forecast of just compensation for harm to the City resulting from Contractor's failure to complete the Work within Contract Time. The amount stipulated will be paid for each day of delay beyond Contract Time until Date of Substantial Completion.

9.12.2 Contractor shall pay the City an amount equal to \$1,200.00 per diesel operating vehicle or piece of motorized equipment per incident of high sulfur diesel fuel usage.

ARTICLE 10 - SAFETY PRECAUTIONS

10.1 *SAFETY PROGRAMS*

10.1.1 Contractor is responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with performance of the Contract. Contractor shall submit a safety program to City Engineer prior to mobilizing for the Work, and is solely responsible for safety, efficiency, and adequacy of ways, means, and methods, and for damage which might result from failure or improper construction, maintenance, or operation performed by Contractor.

10.2 *POLLUTANTS AND POLLUTANT FACILITIES*

10.2.1 If Contractor encounters material on-site which it reasonably believes to be a Pollutant or

facilities which it reasonably believes to be a Pollutant Facility, Contractor shall immediately stop work in affected area and immediately notify City Engineer, confirming the notice thereafter in writing.

10.2.2 If City Engineer determines that the material is a Pollutant or facility is a Pollutant Facility, work in affected area may not be resumed except by Modification, and only if the work would not violate applicable laws or regulations.

10.2.3 If City Engineer determines that the material is not a Pollutant or a facility is not a Pollutant Facility, work in affected area will be resumed upon issuance of a Modification.

10.2.4 Contractor is not required to perform, unless authorized by Change Order, work relating to Pollutants or Pollutant Facilities except for that work relating to Pollutants or Pollutant Facilities specified in the Contract.

10.3 *SAFETY OF THE ENVIRONMENT, PERSONS, AND PROPERTY*

10.3.1 Contractor shall take reasonable precautions for safety and shall provide reasonable protection to prevent damage, injury, or loss from all causes, to:

- .1 employees performing work on-site, and other persons who may be affected thereby;
- .2 work, including Products to be incorporated into the Work, whether in proper storage, under control of Contractor or Subcontractor; and
- .3 other property at or adjacent to the site, such as trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal or replacement in course of construction.

10.3.2 Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons, property, or environment.

10.3.2.1 Contractor shall comply with requirements of Underground Facility Damage Prevention and Safety Act TEX. UTIL. CODE ANN. Ch. 251 (Vernon Supp. 2002).

10.3.2.2 Contractor shall comply with all safety rules and regulations of the Federal Occupational Health and Safety Act of 1970 and subsequent amendments (OSHA).

10.3.3 Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection of persons and property, including posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent sites and utilities.

10.3.4 Contractor shall designate responsible member of Contractor's organization at site whose duty is prevention of accidents. This person will be Contractor's Superintendent unless otherwise designated by Contractor in writing to City Engineer.

10.3.5 Contractor shall prevent windblown dust and may not burn or bury trash debris or waste products on-site. Contractor shall prevent environmental pollution, including but not limited to particulates, gases and noise, as a result of the Work.

10.3.6 When use or storage of hazardous materials or equipment, or unusual methods are necessary for execution of the Work, Contractor shall exercise utmost care and carry on the activities under supervision of properly qualified personnel.

10.3.7 Contractor shall promptly remedy damage and loss to property referred to in Subparagraphs 10.3.1.2 and 10.3.1.3, caused in whole or in part by Contractor, or Subcontractors, which is not covered by insurance required by the Contract. Contractor is not required to remedy damage or loss attributable to the City, Design Consultant, or other contractors.

10.4 *EMERGENCIES*

10.4.1 In emergencies affecting safety of persons or property, Contractor shall act at Contractor's discretion to prevent imminent damage, injury, or loss. Additional compensation or extension of time claimed by Contractor because of emergencies are determined as provided in Article 7.

ARTICLE 11 - INSURANCE AND BONDS

11.1 *GENERAL INSURANCE REQUIREMENTS*

11.1.1 With no intent to limit Contractor's liability under indemnification provisions set forth in Paragraphs 3.25 and 3.26, Contractor shall provide and maintain in full force and effect during term of the Contract and all extensions and amendments

thereto, at least the following insurance and available limits of liability.

11.1.2 If any of the following insurance is written as "claims made" coverage and the City is required to be carried as additional insured, then Contractor's insurance shall include a two-year extended discovery period after last date that Contractor provides any work under the Contract.

11.1.3 Aggregate amounts of coverage, for purposes of the Contract, are agreed to be amounts of coverage available during fixed 12-month policy period.

11.2 INSURANCE TO BE PROVIDED BY CONTRACTOR

11.2.1 *Risks and Limits of Liability:* Contractor shall provide at a minimum insurance coverage and limits of liability set out in Table 1.

11.2.1.1 If Limit of Liability for Excess Coverage is \$2,000,000 or more, Limit of Liability for Employer's Liability may be reduced to \$500,000.

11.2.2 *Form of Policies:* Insurance may be in one or more policies of insurance, form of which is subject to approval by City Engineer. It is agreed, however, that nothing City Engineer does or fails to do with regard to insurance policies relieves Contractor from its duties to provide required coverage and City Engineer's actions or inactions will never be construed as waiving the City's rights.

11.2.3 *Issuers of Policies:* Issuer of any policy shall have:

- .1 a Certificate of Authority to transact business in Texas, or
- .2 have a Best's rating of at least B+ and a Best's Financial Size Category of Class VI or better, according to the most current edition of Best's Key Rating Guide, and the issuer must be an eligible nonadmitted insurer in the State of Texas.

Each insurer is subject to approval by City Engineer in City Engineer's sole discretion as to conformance with these requirements, pursuant to Paragraph 11.2.2.

11.2.4 *Insured Parties:* The City shall be an Additional Insured under this Contract. Each policy, except those for Workers' Compensation and Owner's and Contractor's Protective Liability, must name the City, its officers, agents, and employees as Additional Insured parties on original policy and all

renewals or replacements during term of the Contract. The City's status as Additional Insured under Contractor's insurance does not extend to instances of sole negligence of the City unmixed with any fault of Contractor.

11.2.5 *Deductibles:* Contractor assumes and bears any claims or losses to extent of deductible amounts and waives any claim it may ever have for same against the City, its officers, agents, or employees.

11.2.6 *Cancellation:* Contractor shall notify the Director in writing 30 days prior to any cancellation or material change to Contractor's insurance coverage. Within the 30 day period, Contractor shall provide other suitable policies in lieu of those about to be canceled or nonrenewed so as to maintain in effect the required coverage. If Contractor does not comply with this requirement, the City Engineer, at his or her sole discretion, may:

- .1 immediately suspend Contractor from any further performance under this Contract and begin procedures to terminate for default, or
- .2 purchase the required insurance with City funds and deduct the cost of the premiums from amounts due to Contractor under this Contract.

11.2.7 *Subrogation:* Contractor waives any claim or right of subrogation to recover against the City, its officers, agents, or employees. Each policy, except professional liability, must contain an endorsement waiving such claim.

11.2.8 *Endorsement of Primary Insurance:* Each policy, except Workers' Compensation policies, must contain an endorsement that the policy is primary insurance to any other insurance available to additional insured with respect to claims arising hereunder.

11.2.9 *Liability for Premium:* Contractor is solely responsible for payment of all insurance premium requirements hereunder and the City is not obligated to pay any premiums.

11.2.10 *Additional Requirements for Workers' Compensation Insurance Coverage:* Contractor shall, in addition to meeting the obligations set forth in Table 1, maintain throughout the term of the Contract Workers' Compensation coverage as required by statute, and Contractor shall specifically comply with requirements set forth in Paragraph 11.2.10. The definitions set out below shall apply only for purposes of this Paragraph 11.2.10.

11.2.10.1 Definitions:

- .1 *Certificate of Coverage:* A copy of certificate of insurance, or coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory Workers' Compensation insurance coverage for Contractor's, Subcontractor's, or Supplier's employees providing services for the duration of the Contract.
- .2 *Duration of the Work:* Includes the time from Date of Commencement of the Work until Contractor's work under the Contract has been completed and accepted by City Council.
- .3 *Persons providing services for the Work (Subcontractor in Texas Labor Code § 406.096):* includes all persons or entities performing all or part of services Contractor has undertaken to perform on the Work, regardless of whether that person contracted directly with Contractor and regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of the entity, or employees of entity which furnishes persons to provide services on the Work. Services include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to the Work. Services do not include activities unrelated to the Work, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

11.2.10.2 Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of coverage agreements, which meets the statutory requirements of TEX. LAB. CODE ANN., Section 401.011(44) for employees of Contractor providing services on the Work, for duration of the Work.

11.2.10.3 Contractor shall provide a Certificate of Coverage to the City prior to being awarded the Contract.

11.2.10.4 If coverage period shown on Contractor's original Certificate of Coverage ends during duration of the Work, Contractor shall file new Certificate of Coverage with the City showing that coverage has been extended.

11.2.10.5 Contractor shall obtain from each person providing services on the Work, and provide to City Engineer:

- .1 Certificate of Coverage, prior to that person beginning work on the Work, so the City will have on file Certificates of Coverage showing coverage for all persons providing services on the Work; and
- .2 no later than seven days after receipt by Contractor, new Certificate of Coverage showing extension of coverage, if coverage period shown on current Certificate of Coverage ends during the duration of the Work.

11.2.10.6 Contractor shall retain all required Certificates of Coverage for the duration of the Work and for one year thereafter.

11.2.10.7 Contractor shall notify City Engineer in writing by certified mail or personal delivery, within 10 days after Contractor knew or should have known, of any change that materially affects provision of coverage of any person providing services on the Work.

11.2.10.8 Contractor shall post on-site a notice, in text, form and manner prescribed by Texas Workers' Compensation Commission, informing all persons providing services on the Work that they are required to be covered, and stating how person may verify coverage and report lack of coverage.

11.2.10.9 Contractor shall contractually require each person with whom it contracts to provide services on the Work to:

- .1 provide coverage, based on proper reporting of classification codes, payroll amounts and filing of any coverage agreements, which meets statutory requirements of TEX. LAB. CODE ANN., Section 401.011(44) for all its employees providing services on the Work, for the duration of the Work;
- .2 provide to Contractor, prior to that person's beginning work on the Work, a Certificate of Coverage showing that coverage is being provided for all employees of the person providing services on the Work, for the duration of the Work;
- .3 provide Contractor, prior to the end of the coverage period, a new Certificate of Coverage showing extension of coverage, if the coverage period shown on the current Certificate of Coverage ends during the duration of the Work;

- .4 obtain from each other person with whom it contracts, and provide to Contractor: (1) Certificate of Coverage, prior to other person's beginning work on the Work; and (2) new Certificate of Coverage showing extension of coverage, prior to end of coverage period, if coverage period shown on the current Certificate of Coverage ends during duration of the Work.
- .5 retain all required Certificates of Coverage on file for the duration of the Work and for one year thereafter;
- .6 notify City Engineer in writing by certified mail or personal delivery within 10 days after person knew, or should have known, of change that materially affects provision of coverage of any person providing services on the Work; and
- .7 contractually require each person with whom it contracts to perform as required by Paragraphs 11.2.10.1 through 11.2.10.7, with Certificates of Coverage to be provided to person for whom they are providing services.

11.2.10.10 By signing the Contract or providing or causing to be provided a Certificate of Coverage, Contractor is representing to the City that all employees of Contractor who will provide services on the Work will be covered by Workers' Compensation coverage for the duration of the Work, that coverage will be based on proper reporting of classification codes and payroll amounts,

and that all coverage agreements will be filed with appropriate insurance carrier. Contractor is not allowed to self-insure Workers' Compensation. Contractor may be subject to administrative penalties, criminal penalties, civil penalties, or other civil actions for providing false or misleading information.

11.2.10.11 Contractor's failure to comply with Paragraph 11.2.10 is a breach of the Contract by Contractor, which entitles the City to declare the Contract void if Contractor does not remedy breach within 10 days after receipt of notice of breach from City Engineer.

11.2.11 *Subcontractor Insurance Requirements:* Contractor shall require Subcontractors and Suppliers to obtain Commercial General Liability, Workers' Compensation, Employer's Liability and Automobile Liability coverage that meets all the requirements of Paragraph 11.2. The amount must be commensurate with the amount of the subcontract, but not less than \$500,000 per occurrence. Contractor shall require all Subcontractors with whom it contracts directly, whose subcontracts exceed \$100,000, to provide proof of Commercial General Liability and Automobile Liability insurance coverage meeting the above requirements. Contractor shall comply with all requirements set out under Paragraph 11.2.10 as to Workers' Compensation Insurance for all Subcontractors and Suppliers.

TABLE 1
REQUIRED COVERAGE

(Coverage)	(Limit of Liability)
.1 Workers' Compensation	Statutory Limits for Workers' Compensation
.2 Employer's Liability	Bodily Injury by Accident \$1,000,000 (each accident) Bodily Injury by Disease \$1,000,000 (policy limit) Bodily Injury by Disease \$1,000,000 (each employee)
.3 Commercial General Liability: Including Contractor's Protective, Broad Form Property Damage, Contractual Liability, Explosion, Underground and Collapse, Bodily Injury, Personal Injury, Products, and Completed Operations (for a period of one year following completion of the Work).	Combined single limit of \$1,000,000 (each occurrence), subject to general aggregate of \$1,000,000; Products and Completed Operations \$1,000,000 aggregate.
.4 Owner's and Contractor's Protective Liability	\$1,000,000 combined single limit each Occurrence/aggregate
.5 Installation Floater (Unless alternative coverage approved by City Attorney)	Value of stored material or equipment, listed on Certificates of Payments, but not yet incorporated into the Work
.6 Automobile Liability Insurance: (For automobiles furnished by Contractor in course of his performance under the Contract, including Owned, Non-owned, and Hired Auto coverage)	\$1,000,000 combined single limit each occurrence for (1) Any Auto or (2) All Owned, Hired, and Non-Owned Autos
.7 Excess Coverage	\$1,000,000 each occurrence/combined aggregate in excess of limits specified for Employer's Liability, Commercial General Liability, and Automobile Liability
Aggregate Limits are per 12-month policy period unless otherwise indicated.	

11.3 *PROOF OF INSURANCE*

11.3.1 Prior to commencing services and at time during the term of the Contract, Contractor shall furnish City Engineer with Certificates of Insurance, along with Affidavit from Contractor confirming that Certificate accurately reflects insurance coverage that is available during term of the Contract. If requested in writing by City Engineer, Contractor shall furnish City Engineer with certified copies of Contractor's actual insurance policies. Failure of Contractor to provide certified copies, as requested, may be deemed, at City Engineer's or City Attorney's discretion, a material breach of the Contract.

11.3.2 Notwithstanding the proof of insurance requirements, Contractor shall continuously maintain in effect required insurance coverage set forth in Paragraph 11.2. Failure of Contractor to comply with this requirement does constitute a material breach by Contractor allowing the City, at its option, to immediately suspend or terminate work, or exercise

any other remedy allowed under the Contract. Contractor agrees that the City has not waived or is not estopped to assert a material breach of the Contract because of any acts or omissions by the City regarding its review or non-review of insurance documents provided by Contractor, its agents, employees, or assigns.

11.3.3 Contractor shall provide updated certificates of insurance to the Director upon request. The Contractor shall be responsible for delivering a current certificate of insurance in the proper form to the Director as long as Contractor is required to furnish insurance coverage under Paragraph 11.2.

11.3.4 Every certificate of insurance Contractor delivers in connection with this Contract shall

- .1 be less than 12 months old;
- .2 include all pertinent identification information for the Insurer, including the company name and address, policy

- .3 number, NAIC number or AMB number, and authorized signature; include in the Certificate Holder Box the Project name and reference numbers, contractor's email address, and indicates the name and address of the Project Manager;
- .4 include the Contractor's email address in the Certificate Holder Box;
- .5 include the Project reference numbers on the City address so the Project reference number is visible in the envelope window; and
- .6 be appropriately marked to accurately identify all coverages and limits of the policy, effective and expiration dates, and waivers of subrogation in favor of the City for Commercial General Liability, Automobile Liability, and Worker's Compensation/Employers' Liability.

11.4 *PERFORMANCE AND PAYMENT BONDS*

11.4.1 For Contracts over the value of \$25,000, Contractor shall provide Bonds on the City's standard forms covering faithful performance of the Contract and payment of obligations arising thereunder as required in the Contract pursuant to Chapter 2253 of the Government Code. The Bonds must be for 100 percent of Original Contract Price and in accordance with conditions stated on standard City Performance and Payment Bond and Statutory Payment Bond forms. Bonds may be obtained from Contractor's usual source and cost for the Bonds are included in Contract Price.

11.5 *MAINTENANCE BONDS*

11.5.1 *One-year Maintenance Bond:* Contractor shall provide Bond on standard City One-year Maintenance Bond form, providing for Contractor's correction, replacement, or restoration of any portion of the Work which is found to be not in compliance with requirements of the Contract during one-year correction period required in Paragraph 12.2. The Maintenance Bond must be for 100 percent of the Original Contract Price.

11.6 *SURETY*

11.6.1 A Bond that is given or tendered to the City pursuant to the Contract must be executed by a surety company that is authorized and admitted to write surety Bonds in the State of Texas.

11.6.2 If a Bond is given or tendered to the City pursuant to the Contract in an amount greater than 10 percent of Surety's capital and surplus, Surety shall provide certification that Surety has reinsured that portion of the risk that exceeds 10 percent of Surety's capital and surplus. The reinsurance must be with one or more reinsurers who are duly authorized, accredited, or trusted to do business in the State of Texas. The amount reinsured by reinsurer may not exceed 10 percent of reinsurer's capital and surplus. The amount of allowed capital and surplus must be based on information received from State Board of Insurance.

11.6.3 If the amount of a Bond is greater than \$100,000, Surety shall:

- .1 also hold certificate of authority from the United States Secretary of Treasury to qualify as surety on obligations permitted or required under federal law; or,
- .2 Surety may obtain reinsurance for any liability in excess of \$100,000 from reinsurer that is authorized and admitted as a reinsurer in the State of Texas and is the holder of a certificate of authority from the United States Secretary of the Treasury to qualify as surety or reinsurer on obligations permitted or required under federal law.

11.6.4 Determination of whether Surety on the Bond or the reinsurer holds a certificate of authority from the United States Secretary of the Treasury is based on information published in Federal Register covering the date on which Bond was executed.

11.6.5 Each Bond given or tendered to the City pursuant to the Contract must be on City forms with no changes made by Contractor or Surety, and must be dated, executed, and accompanied by power of attorney stating that the attorney in fact executing such the bond has requisite authority to execute such Bond. The Bonds must be dated and must be no more than 30 days old.

11.6.6 Surety shall designate in its Bond, power of attorney, or written notice to the City, an agent resident in Harris County to whom any requisite notices may be delivered and on whom service of process may be had in matters arising out of the suretyship.

11.6.7 Contractor shall furnish information to a payment bond beneficiary as required by TEX. GOV'T CODE ANN. CH. 2253.

11.7 *DELIVERY OF BONDS*

11.7.1 Contractor shall deliver required Bonds to the City within time limits stated in Notice of Intent to Award and prior to Date of Commencement of the Work.

ARTICLE 12 - UNCOVERING AND CORRECTION OF THE WORK

12.1 *UNCOVERING OF THE WORK*

12.1.1 If a portion of the Work has been covered which City Engineer has not specifically requested to observe prior to its being covered, City Engineer may request to see such work and it must be uncovered by Contractor. If such work is in accordance with the Contract, the costs of uncovering and covering such work are charged to the City by Change Order. If such work is not in accordance with the Contract, Contractor shall pay for uncovering and shall correct the nonconforming Work promptly after receipt of Notice of Noncompliance to do so.

12.2 *CORRECTION OF THE WORK*

12.2.1 Contractor shall promptly correct or remove work rejected by City Engineer or work failing to conform to requirements of the Contract, whether observed before or after Date of Substantial Completion and whether fabricated, Installed, or completed.

12.2.2 Contractor bears costs of correcting the rejected or nonconforming work including additional testing and inspections, and compensation for Design Consultant's services and expenses made necessary thereby.

12.2.3 If within one year after Date of Substantial Completion, or after date for commencement of warranties established under Paragraph 9.9.5 or by other applicable special warranty required by the Contract, whichever is later in time, any of the Work is found not to be in accordance with the requirements of the Contract, Contractor shall correct such work promptly after receipt of Notice of Noncompliance to do so.

12.2.4 One-year correction period for portions of the Work completed after Date of Substantial Completion will begin on the date of acceptance of that portion of the Work. This obligation under this Paragraph survives acceptance of the Work under the Contract and termination of the Contract.

12.2.5 The one-year correction period does not establish a duration for the Contractor's general warranty under Paragraph 3.12. The City retains the right to recover damages from the Contractor as long as may be permitted by the applicable statute of limitations.

12.2.6 If Contractor does not proceed with correction of the nonconforming work within time fixed by Notice of Noncompliance, the City may correct nonconforming work or remove nonconforming work and store salvageable Products at Contractor's expense. Contractor shall pay the costs of correction of nonconforming work and removal and storage of salvageable Products to the City. If Contractor does not pay costs of the correction or removal and storage within 10 days after written notice, the City may sell the Products at auction or at private sale. The City will account for proceeds thereof after deducting costs and damages that would have been borne by Contractor, including compensation for services of Design Consultant and necessary expenses. If the proceeds of sale do not cover costs which Contractor should have borne, Contractor shall pay the value of the deficiency to the City.

12.2.7 Contractor bears cost of correcting work originally installed by Contractor, the City, or by separate contractors and damaged by Contractor's correction or removal of Contractor's work.

12.3 *ACCEPTANCE OF NONCONFORMING WORK*

12.3.1 If City Engineer prefers to accept work which is not in accordance with requirements of the Contract, City Engineer may do so only by issuance of Change Order, instead of requiring its removal and correction. City Engineer will determine Contract Price reduction. The reduction will become effective even if final payment has been made.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

13.1 *GOVERNING LAWS*

13.1.1 The Contract is subject to the laws of the State of Texas, the City Charter and Ordinances, the laws of the federal government of the United States, and all rules and regulations of any regulatory body or officer having jurisdiction.

13.1.2 Venue for any litigation relating to the Contract is Harris County, Texas.

13.2 *SUCCESSORS*

13.2.1 The Contract binds and benefits the Parties and their legal successors and permitted assigns; however, this Paragraph 13.2.1 does not alter the restrictions on assignment and disposal of assets set out in Paragraph 13.3.1. The Contract does not create any personal liability on the part of any officer or agent of the City.

13.3 *BUSINESS STRUCTURE AND ASSIGNMENTS*

13.3.1 Contractor may not assign the Contract at law or otherwise, or dispose of all or substantially all of its assets without City Engineer's prior written consent. Nothing in this Section, however, prevents the assignment of accounts receivable or the creation of a security interest as described in §9.406 of the Texas Business & Commerce Code. In the case of such an assignment, Contractor shall immediately furnish the City with proof of the assignment and the name, telephone number, and address of the assignee and a clear identification of the fees to be paid to the assignee.

13.3.2 Any series, as defined by the TEX. BUS. ORG. CODE ANN., affiliate, subsidiary, or successor to which Contractor assigns or transfers assets shall join in privity and be jointly and severally liable under this Contract.

13.4 *WRITTEN NOTICE*

13.4.1 All notices required or permitted by the Contract must be in writing and must be effected by hand delivery; registered or certified mail, return receipt requested; or facsimile with confirmation copy mailed to receiving Party. Notice is sufficient if made or addressed with proper postage to the address stated in the Agreement for each Party ("Notice Address") or faxed to the facsimile number stated in the Agreement for each Party. The notice is deemed delivered on the earlier of:

- .1 the date the Notice is actually received;
- .2 the third day following deposit in a United States Postal Service post office or receptacle; or
- .3 the date the facsimile is sent unless the facsimile is sent after 5:00 p.m. local time of the recipient and then it is deemed received on the following day.

Any Party may change its Notice Address or facsimile number at any time by giving written notice of the change to the other Party in the manner provided for in this Paragraph at least 15 days prior to the date the change is affected.

13.5 *RIGHTS AND REMEDIES*

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

13.5.2 No act or failure to act by the City or Contractor is a waiver of rights or duties afforded them under the Contract, nor is the act or failure to act constitute approval of or acquiescence in a breach of the Contract. No waiver, approval or acquiescence is binding unless in writing and, in the case of the City, signed by City Engineer.

13.6 *TESTS AND INSPECTIONS*

13.6.1 Contractor shall give City Engineer, Construction Manager, and Design Consultant timely notice of the time and place where tests and inspections are to be made. Contractor shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

13.6.2 The City will employ and pay for services of an independent testing laboratory to perform inspections or acceptance tests required by the Contract except:

- .1 inspections or tests covered by Paragraph 13.6.3;
- .2 those otherwise specifically provided in the Contract; or
- .3 costs incurred in connection with tests or inspections conducted pursuant to Paragraph 12.2.2.

13.6.3 Contractor is responsible for and shall pay all costs in connection with inspection or testing required in connection with City Engineer's acceptance of a Product to be incorporated into the Work, or of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation into the Work.

13.6.4 Neither observations by the City, Construction Manager, or Design Consultant, nor inspections, tests, or approvals by others, relieves Contractor from Contractor's obligations to perform the Work in accordance with the Contract.

13.7 *INTEREST*

13.7.1 No interest will accrue on late payments by the City except as provided under Chapter 2251 of the Government Code.

13.8 *PARTIES IN INTEREST*

13.8.1 The Contract does not bestow any rights upon any third party, but binds and benefits the Parties only.

13.9 *ENTIRE CONTRACT*

13.9.1 The Contract merges the prior negotiations and understandings of the Parties and embodies the entire agreement of the Parties. No other agreements, assurances, conditions, covenants, express or implied, or other terms of any kind, exist between the Parties regarding the Contract.

13.10 *WRITTEN AMENDMENT*

13.10.1 Changes to the Contract that cannot be effected by Modifications, must be made by written amendment, which will not be effective until approved by City Council.

13.11 *COMPLIANCE WITH LAWS*

13.11.1 Contractor shall comply with the Americans with Disabilities Act of 1990 as amended (ADA) and Texas Architectural Barriers Act and all regulations relating to either statute.

13.11.2 Contractor shall comply with all applicable federal, state, and city laws, rules and regulations.

13.12 *SEVERABILITY*

13.12.1 If any part of the Contract is for any reason found to be unenforceable, all other parts remain enforceable to the extent permitted by law.

**ARTICLE 14 - TERMINATION OR SUSPENSION
OF THE CONTRACT**

14.1 *TERMINATION BY THE CITY FOR CAUSE*

14.1.1 Each of the following acts or omissions of Contractor or occurrences shall constitute an "Event of Default" under the Contract:

- .1 Contractor refuses or fails to supply enough properly skilled workers or proper Products;
- .2 Contractor disregards laws, ordinances, rules, regulations, or orders of a public authority having jurisdiction;
- .3 Contractor is guilty of material breach of any duty or obligation of Contractor under the Contract;

.4 Contractor has had any other contract with the City terminated for cause at any time subsequent to the effective date of the Contract as set out in the Agreement; or

.5 Contractor fails to utilize Ultra Low Sulfur Diesel Fuel, as required in Paragraph 3.9.1.1.

14.1.2 If an Event of Default occurs, City Engineer may, at his option and without prejudice to any other rights or remedies which the City may have, deliver a written notice to Contractor and Surety describing the Event of Default and giving the Contractor 10 days to cure the Event of Default. If after the cure period, Contractor has failed or refused to cure the Event of Default, then City Engineer may deliver a second written notice to Contractor giving notice of the termination of the Contract or of the termination of Contractor's performance under the Contract ("Notice of Termination"). If City Engineer issues a Notice of Termination, then City Engineer may, subject to any prior rights of Surety and any other rights of the City under the Contract or at law:

- .1 request that Surety complete the Work; or
- .2 take possession of the site and all materials, equipment, tools, and construction equipment and machinery on the site owned by Contractor; and
- .3 finish the Work by whatever reasonable method City Engineer may deem expedient.

14.1.3 After Contractor's receipt of a Notice of Termination, and except as otherwise directed in writing by City Engineer, Contractor shall:

- .1 stop the Work on the date and to the extent specified in the Notice of Termination;
- .2 place no further orders or subcontracts for Products or services;
- .3 terminate all orders and subcontracts to the extent that they relate to performance of work terminated;
- .4 assign to the City, in the manner, at the times, and to the extent directed by City Engineer, all rights, title, and interest of Contractor, under the terminated supply orders and subcontracts. The City may settle or pay claims arising out of termination of the orders and subcontracts;
- .5 settle all outstanding liabilities and all claims arising out of the termination of supply orders and subcontracts with approval of City Engineer;

- .6 take action as may be necessary, or as City Engineer may direct, for protection and preservation of property related to the Work that is in possession of Contractor, and in which the City has or may acquire an interest; and
- .7 secure the Work in a safe state before leaving the site, providing any necessary safety measures, shoring, or other devices.

14.1.4 If the City terminates the Contract or terminates Contractor's performance under the Contract for any one or more of the reasons stated in Paragraph 14.1.1, Contractor may not receive any further payment until the Work is complete, subject to Paragraph 14.1.5.

14.1.5 If the unpaid balance of Contract Price exceeds the costs of finishing the Work, including liquidated damages and other amounts due under the Contract, the balance will be paid to Contractor. If the costs of finishing the Work exceed the unpaid balance, Contractor shall, within 10 days of receipt of written notice setting out the amount of the excess costs, pay the difference to the City. The amount to be paid to Contractor or the City will be certified by City Engineer in writing, and this obligation for payment shall survive termination of the Contract or termination of Contractor's performance under the Contract. Termination of the Contractor for cause shall not relieve the Surety from its obligation to complete the project.

14.2 *TERMINATION BY THE CITY FOR CONVENIENCE*

14.2.1 City Engineer may, without cause and without prejudice to other rights or remedies of the City, give Contractor and Surety a Notice of Termination with a seven days written notice.

14.2.2 After receipt of the Notice of Termination, and except as otherwise approved by City Engineer, Contractor shall conform to requirements of Paragraph 14.1.3.

14.2.3 After receipt of the Notice of Termination, Contractor shall submit to the City its termination Claim, in forms required by City Engineer. The Claim will be submitted to the City promptly, but no later than six months from the effective date of termination, unless one or more extensions are granted by City Engineer in writing. If Contractor fails to submit its termination Claim within the time allowed, in accordance with Paragraph 14.2.4, City Engineer will determine, on the basis of

available information, the amount, if any, due to Contractor because of termination, and City Engineer's determination is final and binding on the Parties. The City will then pay to Contractor the amount so determined.

14.2.4 City Engineer will determine, on the basis of information available to City Engineer, the amount due, if any, to Contractor for the termination as follows:

.1 Contract Price for all work performed in accordance with the Contract up to the date of termination determined in the manner prescribed for monthly payments in Article 9, except no retainage is withheld by the City either for payment determined by percentage of completion or for materials and equipment delivered to the site, in storage or in transit.

.2 Reasonable termination expenses, including costs for settling and paying Subcontractor and Supplier claims arising out of termination of the Work, reasonable cost of preservation and protection of the City's property after termination, if required, and the cost of Claim preparation. Termination expenses do not include field or central office overhead, salaries of employees of Contractor, or litigation costs, including attorneys' fees.

No amount is allowed for anticipated profit or central office overhead on uncompleted work, or any cost or lost profit for other business of Contractor alleged to be damaged by the termination.

14.2.5 Contractor shall promptly remove from the site any construction equipment, tools, and temporary facilities, except the temporary facilities which City Engineer may wish to purchase and retain.

14.2.6 Contractor shall cooperate with City Engineer during the transition period.

14.2.7 The City will take possession of the Work and materials delivered to the site, in storage, or in transit, as of date or dates specified in the Notice of Termination, and is responsible for maintenance, utilities, security, and insurance, as stated in Notice of Termination.

14.3 *SUSPENSION BY THE CITY FOR CONVENIENCE*

14.3.1 City Engineer may, without cause, after giving Contractor and Surety 24-hour prior written

notice, order Contractor to suspend, delay, or interrupt the Work in whole or in part for a period of time as City Engineer may determine.

14.3.2 An adjustment will be made in Contract Time equivalent to the time of suspension.

14.3.3 Adjustment will be made to Contract Price for increases in the cost of performance of the Work, including profit on increased cost of performance caused by suspension, delay, or interruption of the Work in accordance with Paragraph 7.3. No adjustment will be made to the extent that:

- .1 performance was, or would have been, suspended, delayed, or interrupted by another cause for which Contractor is responsible; or
- .2 adjustment is made or denied under another provision of the Contract.

14.4 *TERMINATION BY CONTRACTOR*

14.4.1 Contractor may terminate the Contract if the Work is stopped for a period of 30 days through no act or fault of Contractor, directly related to one of these events:

- .1 issuance of an order of a court or other public authority having jurisdiction;
- .2 act of government, such as a declaration of national emergency which makes material unavailable; or
- .3 if repeated suspensions, delays, or interruptions by the City as described in Paragraph 14.3 constitute, in the aggregate, more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less;

No termination will be effective for the above reasons if Contractor delivers written notice to City Engineer describing the reason for termination, giving the proposed termination date, and granting the City a reasonable opportunity to respond and cure any City default before termination is effective.

14.4.2 If the Contract is terminated pursuant to this Paragraph 14.4, Contractor shall comply with the requirements of Paragraphs 14.2.2 through 14.2.7.

END OF DOCUMENT

Document 00800

SUPPLEMENTARY CONDITIONS

The following Paragraphs amend and supplement the January 1, 2015 edition of General Conditions. Unaltered portions of General Conditions remain in effect.

ARTICLE 1 - GENERAL PROVISIONS:

1.1 *DEFINITIONS: Insert the following Paragraph 1.1.9.1, and 1.1.23, and reorder the remaining definitions accordingly.*

1.1.9.1 The firm of N/A has been employed by the City as Construction Manager for the Work.

1.1.23 *Good Faith Efforts.* Steps taken to achieve an MBE, WBE, SBE, or PDDBE goal or other requirements which, by their scope, intensity, and usefulness, demonstrate the bidder's responsiveness to fulfill the business opportunity objective, as well as the Contractor's responsibility to put forth measures to meet or exceed the MBE, WBE, SBE, or PDDBE goal (Contract Goal). These steps apply from before a contract's award, through its duration, and after its conclusion, in the event the Contractor has been unsuccessful in meeting the Contract Goal. These efforts are required whether a Goal Oriented Contract or a Regulated Contract, as defined in the Office of Business Opportunity's Policy & Procedures Manual, available at <http://www.houstontx.gov/obo>.

ARTICLE 3 - THE CONTRACTOR

3.5 *LABOR: Insert the following Paragraphs, 3.5.3.1.1, 3.5.3.1.2 and 3.5.3.1.3.*

3.5.3.1.1 If the Original Contract Price is greater than One Million Dollars, Contractor shall make Good Faith Efforts to comply with the City ordinances regarding Minority Business Enterprises (MBE), Women Business Enterprises (WBE), Persons with Disabilities Business Enterprises (PDDBE) and Small Business Enterprise (SBE) participation goals which are as follows:

- .1 the MBE goal is 10.4% percent,
- .2 the WBE goal is 3% percent, and
- .3 the PDDBE goal is 0% percent.

.4 The bidder may substitute SBE participation of no more than four percent of the MBE goal, the WBE goal, or portions of the MBE Goal and WBE Goal.

3.5.3.1.2 The MBE, WBE, PDBE, and SBE goals are specific to this Agreement. The Contractor shall make reasonable efforts to achieve these goals.

3.5.3.1.3 Failure by Contractor to comply with the goals for MBE, WBE, SBE, or PDBE is a material breach of the Agreement, which may result in termination of the Agreement, or such other remedy permitted as the City deems appropriate.

ARTICLE 8 - TIME

8.1 *PROGRESS AND COMPLETION: Add the following Paragraph 8.1.6.1.*

8.1.6.1 Contractor shall credit the City by Change Order for inspection services for overtime work or work performed on Sundays or Legal Holidays. The amount Contractor credits the City will be \$50.00 per hour per inspector for inspection services.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.12 *LIQUIDATED DAMAGES: Insert the following Paragraph 9.12.1.1.*

9.12.1.1 The amount of liquidated damages payable by Contractor or Surety for each and every day of delay beyond Contract Time, are \$800.00 per day.

ARTICLE 11 - INSURANCE AND BONDS

11.2 **INSURANCE TO BE PROVIDED BY CONTRACTOR:** Insert the following Paragraph 11.2.1.2.

11.2.1.2 Contractor shall purchase for the duration of the Contract the insurance set out in Table 2 in addition to the minimum insurance coverage set out in section 11.2.1.

TABLE 2
ADDITIONAL REQUIRED COVERAGE
DEFENSE COSTS EXCLUDED FROM FACE AMOUNT OF POLICY.

<u>(Coverage)</u>	<u>(Limit of Liability)</u>
Property and Casualty Coverage: "All Causes of Loss" Builder's Risk Form for directing physical change to building or plant construction on the Work site and/or all land improvements including all work. (Including but not limited to earthquake, flood, boiler, and machinery including testing, damage to existing or adjoining property, time element coverage, collapse, soft costs	100% of Contract Price, including change orders

(management, architecture, financial costs, pre-opening costs, etc.), transit coverage, off-site storage).

Contractor's Pollution Liability:

\$1,000,000 each occurrence

Including pollution coverage for Contractual Liability, Clean-up costs, Abatement, Transport, and Non-owned disposal sites. Including Bodily Injury Liability, Property Damage Liability, and environmental damage arising from pollution conditions caused in performance of operations. Including Asbestos and Lead if part of operations.

(MCS - 90 endorsement:
to Auto Policy and removal of Pollution
Exclusion)

\$1,000,000
CSL

END OF DOCUMENT

Document 00805

EQUAL EMPLOYMENT OPPORTUNITY PROGRAM REQUIREMENTS
(City of Houston Information Requirements
for the Successful Bidder on All Construction Contracts)

DOCUMENTS THAT MUST BE SIGNED AND RETURNED TO THE CITY OF
HOUSTON PRIOR TO FINAL EXECUTION OF CONTRACT

- Certification by Bidder Regarding Equal Employment Opportunity EEO-3
- Total Work Force Composition of the Company,..... EEO-6
*or in lieu thereof, a copy of the latest Equal Employment Opportunity
Commission's EEO-1 form (This information is required only if the Contractor
has a work force of 50 or more people and the Contract is \$50,000 or more.)*
- Company's Equal Employment Opportunity Compliance Program EEO-7

INFORMATION THAT MUST BE SUPPLIED DURING THE COURSE OF THE WORK

- Certification By Proposed Subcontractor Regarding
Equal Employment Opportunity EEO-26
- Certification by Proposed Material Suppliers, Lessors, and
Professional Service Providers Regarding Equal Employment Opportunity..... EEO-29

PLEASE COMPLETE PAGES EEO-3 THROUGH EEO-7 AND MAIL TO:

City of Houston
Mayor's Office of Business Opportunity
Contract Compliance Section
611 Walker, 7th Floor
Houston, Texas 77002
Attention: Director

The remainder of the reports can be mailed at the appropriate time.

EQUAL EMPLOYMENT OPPORTUNITY PROGRAM REQUIREMENTS

The following are Equal Employment Opportunity requirements to be met and documents to be submitted to:

Mayor's Office of Business Opportunity
Contract Compliance Section
611 Walker, 7th Floor
Houston, Texas 77002

Under the conditions and terms of all City construction contracts, the prime contractor is responsible for all Equal Employment Opportunity compliance, including subcontractor compliance.

EQUAL EMPLOYMENT OPPORTUNITY FORMS (EEO Forms)

These forms are submitted by the prime contractors at the beginning of the Project and as requested:

- EEO Forms 3, 6, and 7, by prime contractors

This form is submitted by all subcontractors before they begin work on the project:

- EEO Form 26 by subcontractors

This form is submitted by all suppliers, lessors, or professional services providers before they begin work on the project:

- EEO Form 29

POSTING

The following poster should be clearly displayed on each job site, or in case of annual service agreements, in the Contractor's office:

Equal Employment Opportunity is the Law Poster

JOB SITE VISITS

Site visits will be made by a Contract Compliance Officer, who will make their presence known to the Project Manager, Supervisor, or Foreman, and will conduct interviews with employees on site.

PAYMENT AND EVALUATION

Upon completion of the Project, as part of the contract-awarding department's total clearance process, the Office of Business Opportunity's Contract Compliance Section must certify to the department that all EEO compliance requirements have been met.

CERTIFICATION BY BIDDER REGARDING
EQUAL EMPLOYMENT OPPORTUNITY

GENERAL

In accordance with Executive Order 11246 (30 F.R. 12319-25), the implementing rules and regulations thereof, and orders of the Secretary of Labor, a certification regarding Equal Opportunity is required of bidders or prospective contractors and their proposed subcontractors prior to the award of contracts or subcontracts.

CERTIFICATION OF BIDDER

Bidder's Name: _____

Address: _____

Telephone Number: _____ Fax : _____

Name of the Company's EEO Officer: _____

E-mail Address: _____

Web Page/URL Address: _____

IRS Employer Identification Number: _____

Work to be performed: _____

Project No: _____

1. Participation in a previous contract or subcontract.
 - a. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause. YES NO
 - b. Compliance reports were required to be filed in connection with such contract or subcontract. YES NO
 - c. Bidder has filed all compliance reports required by Executive Orders 10925, 11114, 11246, or by regulations of the Equal Employment Opportunity Commission issued pursuant to Title VII of the Civil Rights Act of 1964. YES NO
 - d. If answer of Item c. is "No", please explain in detail on reverse side of this certification.

2. Dollar amount of bid:\$ _____
3. Anticipated performance period in days: _____
4. Expected total number of employees to perform the proposed construction: _____
5. Nonsegregated facilities.

a. Notice to prospective federally-assisted construction contractors

- (1) A Certification of Nonsegregated Facilities, as required by the May 9, 1967, Order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted to the recipient prior to the award of a federally-assisted construction contract exceeding \$10,000 which is not exempt from the provisions of the Equal Opportunity Clause.
- (2) Contractors receiving federally-assisted construction contract awards exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity Clause will be required to provide the forwarding of the following notice to prospective subcontractors for supplies and construction contracts where the subcontracts exceed \$10,000 and are not exempt from the provisions of the Equal Opportunity Clause.

The federally-assisted construction Contractor certifies that he/she does not maintain or provide any segregated facilities at any of his/her establishments, and does not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained. The federally-assisted construction Contractor certifies further that he/she will not maintain or provide segregated facilities at any of his/her establishments, and will not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained. The federally-assisted construction Contractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this Contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms 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. The federally-assisted construction Contractor agrees that (except where he/she has obtained identical certifications from proposed Subcontractors for specific time periods) he/she will obtain identical certifications in duplicate from proposed Subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity Clause, and that he/she will retain the duplicate of such certifications in his/her files. The Subcontractor will include the original in his/her bid package.

6. Race or ethnic group designation of bidder. Enter race or ethnic group in appropriate box:

- White Black Hispanic
 Pacific Islander, Asian American Indian, Aleut.

7. Gender of Owner Male Female

REMARKS: _____

Certification - The information above is true and complete to the best of my knowledge and belief.

Company Officer (Please Type)

Signature

Date

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

Total Work Force Composition of the Company

City of Houston, Affirmative Action Requirements for All Construction Contracts

	WHITE		BLACK		HISPANIC		PACIFIC ISLANDER/ ASIAN		ALASKA NATIVE/ AMER IND.		TOTAL PERSONS		TOTAL MINORITY		TOTAL FEMALE	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
OFFICIALS AND ADMINISTRATORS																
PROFESSIONALS																
PARAPROFESSIONALS																
TECHNICIANS																
PROTECTIVE SERVICE WORKERS																
SALES WORKERS																
OFFICE AND CLERICAL																
SKILLED CRAFT WORKERS																
OPERATIVES (SEMI-SKILLED)																
LABORERS (UNSKILLED)																
SERVICE / MAINTENANCE WORKERS																
OTHERS																
TOTAL																

This report includes all of the company's permanent work force. For description of job categories, see Pages CC-27 through CC-29.

Check One: Contractor Subcontractor DATE: _____

**EQUAL EMPLOYMENT OPPORTUNITY COMPLIANCE PROGRAM
FOR**

Name of Company

The Company's Office of Business Opportunity Program shall consist of documented good faith efforts to comply with the goals, timetables, and objectives set forth in the following Affirmative Action steps:

- A. City of Houston's Specific Equal Employment Opportunity Policy and Clause as contained in City Council Ordinance No. 78-1538, passed August 9, 1978.
- B. Notice of Requirement for Office of Business Opportunity to ensure Equal Employment Opportunity (Executive Order 11246).
- C. Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246).

Project: _____

Company Officer (Please Type)

Signature

Date

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

**SPECIAL PROVISIONS
SPECIFIC EQUAL EMPLOYMENT OPPORTUNITY POLICY**

1. GENERAL

- a. Equal employment opportunity requirements not to discriminate and to take affirmative action to assure equal employment opportunity are required by Executive Order 11246, as amended. The requirements set forth in these Special Provisions shall constitute the specific affirmative action requirements for Project activities under this Contract and shall supplement the notice of requirement for affirmative action to ensure equal employment opportunity and standard federal equal employment opportunity construction contract specifications.
- b. The Contractor shall work with the City and the Federal Government in carrying out equal employment opportunity obligations and in their review of his/her activities under the Contract.
- c. The prime Contractor and all Subcontractors holding subcontracts of \$10,000 or more shall comply with the following minimum specific requirement activities of equal employment opportunity. The Contractor shall include these requirements in every subcontract of \$10,000 or more with such modification of language as is necessary to make them binding on the Subcontractor.

2. EQUAL EMPLOYMENT OPPORTUNITY POLICY

The Contractor shall accept as his/her operating policy the following statement which is designed to further the provision of equal employment opportunity to all persons without regard to their race, age, color, religion, sex, or national origin, and to promote the full realization of equal employment opportunity through a positive continuing program:

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, color, sex, or national origin. 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.

3. EQUAL EMPLOYMENT OPPORTUNITY OFFICER

The Contractor shall designate and make known to the City contracting officers an equal employment opportunity officer (hereinafter referred to as the EEO Officer) who must be capable of effectively administering and promoting an active Contractor program of equal employment opportunity and who must be assigned adequate authority and responsibilities to do so.

4. DISSEMINATION OF POLICY

- a. 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 equal employment opportunity policy and contractual responsibilities to provide equal employment opportunity in each grade and classification of employment. To ensure that the above agreement will be met, the following actions shall be taken as a minimum:
- (1) Periodic meetings of supervisory and personnel office employees shall be conducted before the start of work and then not less often than once every six months, at which time the Contractor's equal employment opportunity policy and its implementation will be reviewed and explained. The meetings shall be conducted by the EEO Officer or other knowledgeable company official.
 - (2) All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, or other knowledgeable company official, covering all major aspects of the Contractor's equal employment opportunity obligations, within 30 days following their reporting for duty with the Contractor.
 - (3) The EEO Officer or appropriate company official shall instruct all employees engaged in the direct recruitment of employees for the Project relative to the methods followed by the Contractor in locating and hiring minorities and females.
- b. In order to make the Contractor's equal employment opportunity policy known to all employees, prospective employees, and potential sources of employees, i.e., schools, employment agencies, labor unions (where appropriate), college placement officers, etc., the Contractor shall take the following actions:
- (1) Notices and posters setting forth the Contractor's equal employment opportunity policy shall be placed in areas readily accessible to employees, applicants for employment, and potential employees.
 - (2) The Contractor's equal employment opportunity policy and the procedures to implement such policy shall be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

5. RECRUITMENT

- a. When advertising for employees, the Contractor shall include in all advertisements for employees the notation "An Equal Opportunity Employer". All such advertisements will be published in newspapers, or

other publications, having a large circulation among minority groups in the area from which the Project work force would normally be derived.

- b. The Contractor shall, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee-referral sources likely to yield qualified minority-group applicants, including, but not limited to, State employment agencies, schools, colleges, minority-group organizations, and female recruitment agencies. To meet this requirement, the Contractor shall, through his/her EEO Officer, identify sources of potential minority and female employees, and establish with such identified sources procedures whereby such group applicants may be referred to the Contractor for employment consideration.

In the event the Contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, he/she is expected to observe the provisions of that agreement to the extent that the system permits the Contractor's compliance with equal employment opportunity Contract provisions. (The U. S. Department of Labor has held that where implementation of such agreements has the effect of discriminating against minorities or women, or obligates the Contractor to do the same, such implementation violates Executive Order 11246 as amended).

- c. The Contractor shall encourage his/her present employees to refer female or minority-group applicants for employment by posting appropriate notices or bulletins in areas accessible to all such employees. In addition, information and procedures with regard to referring such applicants will be discussed with employees.

6. PERSONNEL ACTIONS

- a. Wage, 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, or age. The following procedures shall be followed:

- (1) The Contractor shall conduct periodic inspections of Project sites to ensure that working conditions and employee facilities do not indicate discriminatory treatment of Project-site personnel.

- (2) The Contractor shall periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

- (3) The Contractor shall periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the Contractor shall 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.

- (4) The Contractor shall promptly investigate all complaints of alleged discrimination made in connection with his/her obligations under this Contract, shall attempt to resolve such complaints, and shall take appropriate corrective action. 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 shall inform every complainant of all avenues of appeal.

7. TRAINING AND PROMOTION

- a. The Contractor shall assist in locating, qualifying, and increasing the skills of minority-group and women employees and applicants for employment.
- 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.
- c. The Contractor shall advise employees and applicants for employment of available training programs and entrance requirements for each.
- d. The Contractor shall periodically review the training and promotion potential of minority-group and women employees and shall encourage eligible employees to apply for such training and promotion.

8. UNIONS

If the Contractor relies in whole or in part upon unions as a source of employees, he/she shall use his/her best efforts to obtain the cooperation of such unions to increase minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. Actions by the Contractor, either directly or through a contractor's association acting as his/her agent, will include the procedures set forth below:

- a. The Contractor shall use best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority-group members and women for membership in the unions and increasing the skills of minority-group employees and women so that they may qualify for higher-paying employment.
- b. The Contractor shall use best efforts to incorporate an equal employment opportunity clause into all union agreements to the end that such unions will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, or age.

- 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 City 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 minority and women referrals within the time limit set forth in the collective bargaining agreement, the Contractor shall, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, age, sex, or national origin, making full efforts to obtain qualified and/or qualifiable minority group persons and women. (The U. S. Department of Labor has held that it shall be no excuse that the union with which the Contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees.) 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 City.

9. SUBCONTRACTING

- a. The Contractor shall use his/her best efforts to solicit bids from and to utilize minority-group and female subcontractors or subcontractors with meaningful minority-group and/or female representation among their employees.
- b. The Contractor shall use his/her best efforts to assure Subcontractors' compliance with their equal employment opportunity obligations.

10. RECORDS AND REPORTS

- a. The Contractor shall keep such records as are necessary to determine compliance with the Contractor's equal employment opportunity obligations. The records kept by the Contractor will be designed to indicate:
 - (1) The number 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 to increase employment opportunities for minorities and women (applicable only to contractors who rely in whole or in part on unions as a source of their work force).
 - (3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees.

- (4) The progress and efforts being made in securing the services of female and minority subcontractors.

- b. All records, including payrolls, must be retained for a period of three years following completion of the Contract work and shall be available at reasonable times and places for inspection by authorized representatives of the City and/or the appropriate federal agency.

CITY OF HOUSTON, TEXAS

EQUAL EMPLOYMENT OPPORTUNITY CLAUSE

Pursuant to City Council Ordinance No. 78-1538, passed August 9, 1978, all contracts entered into by the City of Houston involving the expenditure of \$10,000 or more, shall incorporate the following Equal Employment Opportunity Clause:

1. The Contractor, Subcontractor, vendor, Supplier, or lessee shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, or age. The Contractor, Subcontractor, vendor, Supplier, or lessee shall take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, religion, color, sex, national origin, or age. Such action will include, but not be limited to, the following: employment; upgrading; demotion or transfer; recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor, Subcontractor, vendor, Supplier, or lessee agrees to post in conspicuous places available to employees, and applicants for employment, notices to be provided by the City setting forth the provisions of this Equal Employment Opportunity Clause.
2. The Contractor, Subcontractor, vendor, Supplier, or lessee states that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national origin, or age.
3. The Contractor, Subcontractor, vendor, Supplier, or lessee shall send to each labor union or representatives of workers with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided by the agency contracting officer advising the said labor union or workers' representative of the Contractor's and Subcontractor's commitments under Section 202 of Executive Order No. 11246, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
4. The Contractor, Subcontractor, vendor, Supplier, or lessee will comply with all provisions of Executive Order No. 11246 and the rules, regulations, and relevant orders of the Secretary of Labor or other Federal Agency responsible for enforcement of the equal opportunity and affirmative action provisions applicable, and shall likewise furnish all information and reports required by the Mayor and/or Contractor Compliance Officers for purposes of investigation to ascertain and effect compliance with this program.

5. The Contractor, Subcontractor, vendor, Supplier, or lessee shall furnish all information and reports required by Executive Order No. 11246, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and shall permit access to all books, records, and accounts by the appropriate City and Federal officials for purposes of investigation to ascertain compliance with such rules, regulations, and orders. Compliance reports filed at such times as directed shall contain information as to the employment practice policies, program, and work force statistics of the Contractor, Subcontractor, vendor, Supplier, or lessee.
6. In the event of a Contractor's, Subcontractor's, vendor's, Supplier's, or lessee's non-compliance with the non-discrimination clause of this Contract or with any of such rules, regulations, or orders, this Contract may be canceled, terminated, or suspended in whole or in part, and the Contractor, Subcontractor, vendor, Supplier, or lessee may be declared ineligible for further City contracts in accordance with procedures provided in Executive Order No. 11246, and such other sanctions may be imposed and remedies invoked as provided in said Executive Order, or by rule, regulation, or order of the Secretary of Labor, or as may otherwise be provided by law.
7. The Contractor shall include the provisions of paragraphs 1 through 8 of this Equal Employment Opportunity Clause 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 No. 11246 of September 24, 1965 so that such provisions will be binding upon each Subcontractor or vendor. The Contractor shall take such action with respect to any subcontractor or purchase order as the contracting agency may direct as a means of enforcing such provisions, including sanctions for noncompliance; provided, however, that in the event the Contractor becomes involved in, or is threatened with litigation with a Subcontractor or vendor as a result of such direction by the contracting agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.
8. The Contractor shall file and shall cause each of his Subcontractors, if any, to file compliance reports with the City in the form and to the extent as may be prescribed by the Mayor's Office of Business Opportunity. Compliance reports filed at such times as directed shall contain information as to the practices, policies, programs, employment policies, and employment statistics of the Contractor and each Subcontractor.

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION
TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY
(EXECUTIVE ORDER 11246)

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.
2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate work force in each trade on all construction work in the covered area, are as follows:

Timetable	Goals for Minority Participation for Each Trade	Goals for Female Participation for Each Trade
	26.2% - 27.3%	6.9%

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or Federally-assisted) performed in the covered area.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals established for the geographical area where the Contract resulting from this solicitation is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the Contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the Contract, the Executive Order, and regulations in 41 CFR part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the Contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the Subcontractor; employer identification number; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the Contract is to be performed.
4. As used in this Notice, and in the Contract resulting from this solicitation, the "covered area" is The Houston, Texas Standard Metropolitan Statistical Area.

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY
CONSTRUCTION CONTRACT SPECIFICATIONS
(EXECUTIVE ORDER 11246)

1. As used in these specifications:
 - a. "Covered area" means the geographical area described in the solicitation from which this Contract resulted;
 - b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
 - c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U. S. Treasury Department Form 941.
 - d. "Minority" includes:
 - (i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
 - (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin regardless of race);
 - (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
 - (iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).
2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this Contract resulted.
3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U. S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for

those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in Paragraphs 7a through p of these specifications. The goals set forth in the solicitation from which this Contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress toward its goals in each craft during the period specified.
5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement to refer either minorities or women, shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.
6. In order for the non-working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U. S. Department of Labor.
7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:
 - a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which Contractor's employees are assigned to work. The Contractor, where possible, shall assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

- b. Establish and maintain a current list of minority and female recruitment sources; provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.
- c. Maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source, or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.
- d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.
- e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.
- f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
- g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination, or other employment decisions, including specific review of these items with on-site supervisory personnel such as superintendents, general foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of

these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

- h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other contractors and subcontractors with whom the Contractor does or anticipates doing business.
- i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
- j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer, and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.
- k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.
- l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare, through appropriate training, etc., for such opportunities.
- m. Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.
- n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
- o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

- p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.
8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor union, contractor-community, or other similar group of which the Contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female work force participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.
9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is under utilized).
10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.
11. The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.
12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination, and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.
13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in Paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the

Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.B.

14. The Contractor shall designate a responsible official to monitor all employment-related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government, and to keep records. Records shall at least include for each employee the name, address, telephone number, construction trade, union affiliation, if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily-understandable and retrievable form; however to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.
15. 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 (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

DESCRIPTION OF JOB CATEGORIES

Officials, Managers, and Administrators

Occupations requiring administrative personnel who set board policies, exercise overall responsibility for the execution of these policies, or provide specialized consultation on a regional, district, area basis, or direct individual departments or special phases of a firm's operations.

Includes: Officials, executives, middle management, plant managers, department managers, superintendents, salaried foremen who are members of management, purchasing agents, buyers, bureau chiefs, directors, deputy directors, wardens, examiners, sheriffs, police and fire chiefs, and kindred workers.

Professionals

Occupations which require specialized and theoretical knowledge which is usually acquired through college or experience of such kind and amount as to provide a comparable background.

Includes: Accountants, auditors, airplane pilots and navigators, architects, artists, chemists, designers, dieticians, editors, engineers, lawyers, librarians, mathematicians, natural scientists, registered professional nurses, personnel and labor relations workers, physical scientists, teachers, social workers, doctors, psychologists, economists, systems analysts, employment and vocational rehabilitation counselors, instructors, police and fire captains and lieutenants, and kindred workers.

Paraprofessionals

Occupations in which workers perform some of the duties of a professional or technician in a supportive role, which usually requires less formal training and/or experience normally required for professional or technical status. Such positions may fall within an identified pattern of a "New Careers" concept.

Includes: Library assistants, medical aides, child support workers, police auxiliary, welfare service aides, recreation assistants, homemakers aides, home health aides, and kindred workers.

Technicians

Occupations requiring a combination of basic scientific knowledge and manual skill which can be obtained through about two (2) years of post high school education, such as is offered in many technical institutes and junior colleges, or through equivalent on-the-job training.

Includes: Computer programmers and operators, draftsmen, engineering aides, junior engineers, mathematical aides, licensed practical or vocational nurses, photographers, radio operators, scientific assistants, surveyors, technical illustrators, technicians (medical, dental, electronics, physical sciences), police and fire sergeants, and kindred workers.

Protective Service Workers

Occupations in which workers are entrusted with public safety, security, and protection from destructive forces.

Includes: Police patrol officers, fire fighters, guards, deputy sheriffs, bailiffs, correctional officers, detectives, marshals, harbor patrol officers, and kindred workers.

Sales Workers

Occupations engaging wholly or primarily in direct selling.

Includes: Advertising agents and salespersons, insurance agents and brokers, real estate agents and brokers, stock and bond salespersons, demonstrators, salespersons and sales clerks, grocery clerks, cashiers, and kindred workers.

Office and Clerical

Occupations in which workers are responsible for internal and external communications, recording and retrieval of data and/or information and other paper work required in an office predominantly non-manual, though some manual work not directly involved with altering or transporting the products is included.

Includes: Bookkeepers, cashiers, collectors (bills and accounts), messengers and office helpers, office machine operators, shipping and receiving clerks, stenographers, typists and secretaries, telegraph and telephone operators, court transcribers, hearing reporters, statistical clerks, dispatchers, license distributors, payroll clerks, and kindred workers.

Skilled Craft Workers

Occupations in which workers perform jobs which require special manual skill through on-the-job training and experience, or through apprenticeship or other formal training programs. These workers exercise considerable independent judgment and usually receive an extensive period of training.

Includes: The building trades, hourly paid foremen and leadmen who are not members of management, mechanics and repairmen, skilled machining occupations, compositors and typesetters, electricians, engravers, job setters

(metal), motion picture projectionists, pattern and model makers, stationary engineers, tailors, heavy equipment operators, carpenters, and kindred workers.

Operatives (semi-skilled)

Workers who operate machine or processing equipment or perform other factory-type duties of intermediate skill level which can be mastered in a few weeks and require only limited training.

Includes: Apprentices (auto mechanics), plumbers, bricklayers, carpenters, electricians, mechanics, building trades, metal workers, machinists, printing trades, operatives, attendants (auto service and parking), blasters, chauffeurs, deliverymen, dressmakers and seamstresses (except factory), dryers, furnacemen, heaters (metal), laundry and dry cleaning operatives, milliners, miners, motormen, oilers, greasers, etc. (except auto), painters (except construction and maintenance), photographic process workers, stationary firemen, truck and tractor drivers, weavers (textile), welders and flame cutters, and kindred workers.

Laborers (unskilled)

Workers in manual occupations which generally require no special training. These workers perform elementary duties that may be learned in a few days and require the application of little or no independent judgment.

Includes: Garage workers, car washers and greasers, gardeners (except farm) and groundskeepers, longshoremen and stevedores, lumbermen, craftsmen, and wood choppers, laborers performing lifting, digging, mixing, loading, and pulling operations, and kindred workers.

Service/Maintenance Workers

Occupations in which workers perform duties which result in or contribute to the comfort, convenience, hygiene or safety for the general public or which contribute to the upkeep and care of buildings, facilities or grounds, or public property. Workers in this group may operate machinery.

Includes: Chauffeurs, laundry and dry cleaning operatives, truck drivers, trash collectors, custodial personnel, gardeners and groundskeepers, construction laborers, attendants (hospital and other institutions), professional and personal service, counter and fountain workers, elevator operators, firemen and fire protection, guards, watchmen and doorkeepers, stewards, porters, waiters, and kindred workers.

4. Expected total number of employees to perform the proposed subcontract: _____

5. Nonsegregated facilities.
 - a. Notice to prospective federally-assisted construction contractors
 - (1) A Certification of Nonsegregated Facilities, as required by the May 9, 1967, order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted to the Contractor prior to the award of a subcontract exceeding \$10,000 which is not exempt from the provisions of the Equal Opportunity Clause.
 - (2) Contractors receiving subcontract awards exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity Clause will be required to provide for the forwarding of this notice to prospective subcontractors for supplies and construction contracts where the subcontracts exceed \$10,000 and are not exempt from the provisions of the Equal Opportunity clause.

 - b. Certification of non-segregated facilities

The federally-assisted construction contractor certified that he/she does not maintain or provide any segregated facilities at any of his/her establishments, and does not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained. The federally-assisted construction Contractor certifies further that he/she will not maintain or provide any segregated facilities at any of his/her establishments, and will not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained. The federally-assisted construction Contractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this Contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms 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. The federally-assisted construction Contractor agrees that (except where he/she has obtained identical certifications from proposed Subcontractors for specific time periods) he/she will obtain identical certifications in duplicate from proposed Subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity Clause, and that he/she will retain the duplicate of such certifications in his/her files. The Contractor will include the original in his/her Bid Package.

6. Race or ethnic group designation of bidder. Enter race or ethnic group in appropriate box:

White Black Hispanic

Pacific Islander, Asian American Indian, Aleut.

7. Gender

Male Female

REMARKS: _

Certification - The information above is true and complete to the best of my knowledge and belief.

Company Officer (Please Type)

Signature

Date

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

Certification by Proposed Material Suppliers, Lessors, and Professional Service
Providers Regarding Equal Employment Opportunity

Company Name: _____ \$ _____
(Supplier, Lessor, Professional Service Provider) (Amount of Contract)

Company Address: _____

Company Telephone Number: _____ Fax: _____

E-mail Address: _____

Web Page/URL Address: _____

Company Tax Identification Number: _____

Project No.: [WBS/CIP/AIP/File No.]

Project Name: [Legal Project Name]

In accordance with the City of Houston Ordinance 78-1538, Supplier/Lessor/Professional Service Provider represents to be an equal opportunity employer and agrees to abide by the terms of the Ordinance. This certification is required of all Suppliers/Lessors/Professional Service Providers (herein Supplier) with contracts in the amount of \$10,000.00 or more.

- Yes No Supplier agrees not to discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, or age.
- Yes No Supplier agrees that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national origin, or age.
- Yes No Supplier will comply with all provisions of Executive Order No. 11246 and rules, regulations and applicable orders of the Department of Labor or other Federal Agency responsible for enforcement of applicable equal opportunity and affirmative action provisions and will likewise furnish all information and reports required by the Mayor or Contract Compliance Officers for the purpose of investigation to ascertain and effect compliance with the City of Houston's Office of Affirmative Action and Contract Compliance.
- Yes No The Supplier shall file and cause their sub-tier contractors to file compliance reports with the City in the form and to the extent as may be prescribed by the Mayor or Contract Compliance Officers. Compliance reports filed at such times as directed shall contain information including, but not limited to, the practices, policies, programs, and employment policies.

I hereby certify that the above information is true and correct.

COMPANY OFFICER (Signature)

DATE

NAME AND TITLE (Print or type)

END OF DOCUMENT

Document 00808

**REQUIREMENTS FOR
THE CITY OF HOUSTON PROGRAM FOR
MINORITY, WOMEN, AND SMALL BUSINESS ENTERPRISES
AND PERSONS WITH DISABILITIES ENTERPRISES (PDBE)**

CONSTRUCTION CONTRACTS

I. GENERAL

A. CITY AUTHORITIES

1. The "OBO Director" is the City of Houston's Office of Business Opportunity Director, or his or her designee.
City of Houston
611 Walker Street, 7th Floor
Houston, Texas 77002
2. The "Contracting Department" for this Project is the City of Houston Department specified in Document 00520 – Agreement.
3. The "Project Manager" is for this Project specified in Document 00550 – Contract Approval Notification.

II. REOCCURRING REPORTS THAT MUST BE SUBMITTED DURING THE COURSE OF THE CONTRACT:

A. MWSBE MONTHLY REPORT PROCESS

The Contractor shall complete the MWSBE Monthly Utilization Report in the Contract Compliance and Monitoring System (available at <https://houston.mwdbe.com/>).

- B.** The Contractor shall comply with further, applicable instructions regarding reporting and compliance as provided in Sections III.E and III.I below.

iii. BUSINESS ENTERPRISE PROGRAM REQUIREMENTS:

A. PURPOSE

This Document facilitates implementation of City of Houston, Tex. Code of Ordinances Chapter 15, Article V, § 15-81 et seq., relating to MWSBE contract participation, and Code of Ordinances Chapter 15, Article VI, § 15-90 et seq., relating to PDBE contract participation (collectively, the “Business Enterprise Program or “MWSBE”). City of Houston, Tex. Ordinance 2013-0428, May 8, 2013.

B. POLICY

It is the policy of the City to encourage the full participation of Minority and Women-owned Business Enterprises, Small Business Enterprises, and Persons with Disabilities Business Enterprises in all phases of its procurement activities and to afford them a full and fair opportunity to compete for City contracts at all levels.

C. POLICY ELEMENTS

1. The Contractor agrees to ensure that MWSBE firms have a full and fair opportunity to participate in the performance of City contracts. In this regard the Contractor shall make all reasonable Good Faith Efforts to meet the Contract Goals for this Contract.
2. The Contractor and any Subcontractor shall not discriminate on the basis of race, color, religion, national origin, or sex in the performance of City contracts.
3. Contractor's performance in meeting the Participation Plan Percentage will be monitored during the construction phase of the Contract by the OBO Director and Contracting Department.

D. PERCENTAGE GOALS

The MWSBE goals and PDBE goals, if any, for the Work are specified in Document 00800 – Supplementary Conditions Goals.

E. CONTRACTOR RESPONSIBILITIES

1. Prior to Award:

The Bidder shall submit MWSBE documents in accordance with the requirements of Document 00410 – Bid Form Part A.

- a. In accordance with the Code of Ordinances and the OBO Good Faith Efforts Policy (Attachment A), the Department shall approve an Apparent Low Bidder's MWSBE Participation Plan—Document 00470 (the "Bidder's Plan" or "Plan") within 3 business days of the Bid Opening only if the Department representative determines that Bidder's Plan meets the advertised Contract Goal and is administratively complete.
- b. If the Department cannot approve the Bidder's Plan, it shall forward the Plan to the OBO Director, who shall review the Bidder's Plan, and if applicable, the Bidder's Document 00471 (Record of Good Faith Efforts) and Document 00472 (Pre-Award Deviation Request) and determine whether the Bidder has made Good Faith Efforts to meet the Contract Goals within 10 business days of the Bid Opening.
- c. If the OBO Director determines that the Bidder has failed to provide a valid participation plan or make Good Faith Efforts or if the Bidder fails to provide documents and associated information required by this Document 00808 or reasonably requested in writing by the OBO Director, the OBO Director may declare the Bidder to be non-responsible.
- d. If the OBO Director determines that the Bidder has made Good Faith Efforts, the Director may approve the Bidder's Contract Goal Deviation request. Thereafter, the Bidder/Contractor shall be bound by the Plan, as approved by the OBO Director.
- e. The Contractor shall:
 - (1) ensure that all MWSBE firms listed in the Plan are certified by the Office of Business Opportunity prior to bid date. Qualified, non-certified firms may obtain priority consideration for certification if no more than two firms are certified with the same capability as the non-certified firm.
 - (2) execute written contracts with all certified Subcontractors and Suppliers. All such contracts must be executed and sent to the OBO Director and Contracting Department within 30 days after the date of the Notice to Proceed and must include provisions set forth in Articles 3 and 5 of Document 00700 - General Conditions.
 - (3) designate an MWSBE liaison officer who will administer the Contractor's MWSBE program and who shall document and maintain records of Good Faith Efforts to subcontract with MWSBE Subcontractors and Suppliers.

2. After Award:

- a. The Contractor shall submit MWSBE Monthly Utilization Reports, requested in Article II above.
- b. The Contractor shall complete and submit to the OBO Director a Post-Award Deviation Request–Document 00572 (“Post-Award Deviation Request”) if the Contractor reasonably believes that it will not achieve the Business Enterprise Program Participation Plan Percentage documented in the Plan. The Contractors shall also submit to the OBO Director, with a Copy to the Contracting Department, a Record of Post-Award Good Faith Efforts (Document 00571) for each Certified Firm that the Contractor does not use in accordance with the Approved Plan before the Contractor uses another firm to perform the work.
- c. The Contractor shall conform to the Plan unless the OBO Director grants a Post-Award Deviation Request. The OBO Director shall approve or reject a Deviation Request within 5 business days of receipt of the Deviation Request.
- d. The OBO Director shall grant a Post-Award Deviation Request if
 - (1) for a reason beyond the Contractor’s control, the Contractor is unable to use the certified MWSBE firm in the Plan to perform the specified work. In such cases, the Contractor shall use and document Good Faith Efforts to find a similarly qualified, certified MWSBE firm to perform such specified work; or
 - (2) the Contractor reasonably believes that, due to a change of scope, execution of the work in accordance with the directions from the Contracting Department is unlikely to meet the terms of the Plan. In such cases, the Contractor shall use and document Good Faith efforts to achieve a reasonable amount of MWSBE participation on the remaining work on the Contract.
 - (3) The OBO Director shall not unreasonably withhold approval of a Post-Award Deviation Request.
- e. After the Date of Substantial Completion, the OBO Director shall evaluate the Contractor’s Good Faith Efforts towards meeting the Plan, as it may amended.
- f. If the Contractor fails to conform to the Plan and fails to submit a Post-Award Deviation Request or provide documents and associated information required by the Good Faith Efforts Policy or reasonably requested in writing by the OBO Director, the OBO Director may impose sanctions in accordance with Article VI of this Document 00808.

F. ELIGIBILITY OF MWSBE FIRMS FOR SUBCONTRACTING

1. To ensure that the City's Business Enterprise Program benefits only those firms that are owned and controlled by a minority person(s), a woman (women), a person(s) with a disability, or a small business enterprise, the Office of Business Opportunity will certify the eligibility of MWSBE and PDBE Contractors, Subcontractors, and Suppliers. Contact the Office of Business Opportunity Certification Section at 832-393-0600 for information regarding certification.
2. The Office of Business Opportunity maintains a Certified Minority, Women and Small Business Enterprises and Disabilities Business Enterprises Directory on the City's website. This Directory also lists federally-designated Disadvantaged Business Enterprises (DBEs).

NOTE: MWSBE firms, even if certified by another agency, may not qualify for Contract Goals unless certified by the Office of Business Opportunity prior to acceptance of the Participation Plan.

G. DETERMINATION OF MWSBE PARTICIPATION

MWSBE participation shall be counted toward meeting the Contract Goals in response to the following:

1. Once a firm is certified as a MWSBE firm, the total dollar value of the subcontract awarded to the MWSBE firm is counted toward the Contract Goals (See Sections III.G.4 and III.G.5 below). Safety and Participation goals do not count as a single goal concerning MWSBE/DBE requirements.
2. When the Contractor or Subcontractor is in a joint venture with one or more MWSBE firms, the OBO Director shall determine the percent of participation resulting from such joint venture to be counted toward the Contract Goals.
3. Contractor may count toward its Contract Goals only those MWSBE Subcontractors/Suppliers performing a Commercially Useful Function.
 - a. **COMMERCIALLY USEFUL FUNCTION** means a discrete task or group of tasks, the responsibility for performance of which shall be discharged by the MWSBE firm by using its own forces or by actively supervising on-site the execution of the tasks by another entity for whose work the MWSBE firm is responsible. In determining whether a certified firm is performing a commercially useful function, factors including but not limited to the following shall be considered: (1) whether the firm has the skill and expertise to perform the work for which it is being utilized and possesses all necessary licenses; (2) whether the firm is in the business of performing, managing, or supervising the work for which it has been certified and is being utilized; and

(3) whether it is performing a real and actual service that is a distinct and verifiable element of the work called for in a contract. Without limiting the generality of the foregoing, a MWSBE will not be considered to be performing a commercially useful function, if it subcontracts to non-MWSBE firms or to other MWSBE firms, more than 50 percent of a contract being counted toward the applicable Contract Goals, unless such subcontracting in excess of 50 percent has been expressly approved by the OBO Director in a Goal or Plan Deviation Request (Document 00472 or Document 00572) (either pre-bid or post award).

- b.** The OBO Director shall approve a Plan Deviation Request if the Contractor demonstrates that the industry standard for the type of work involved is to subcontract over 50 percent of the work.
- 4.** A MWSBE firm cannot subcontract more than 50 percent of the work for which it is responsible to perform unless the OBO Director grants a Deviation Approval.
- 5.** The Contractor may count 100 percent of MWSBE Manufacturer Supplier's participation and 60 percent of MWSBE Non-Manufacturer Supplier's participation toward its Contract Goals. Such MWSBE Supplier contracts shall not exceed 50 percent of contract's goals.
- 6.** The OBO Policy and Procedures Manual, as amended, shall apply to the Contract for other determinations regarding counting MWSBE participation not explicitly provided for in the Contract.

H. CONTRACTOR COMPLIANCE

To ensure compliance with MWSBE requirements, the OBO Director and Contracting Department will monitor Contractor's efforts regarding MWSBE Subcontractors/Suppliers during the performance of this Contract. This may be accomplished through the following: job site visits, reviewing of records and reports, and interviews of randomly selected personnel.

I. RECORDS AND REPORTS

1. In accordance with II.A of this Document, the Contractor shall submit an initial report outlining MWSBE participation, 40 days after the Notice to Proceed date, and on or before the 15th day of each month thereafter until all MWSBE subcontracting or material supply activity is completed. Each report shall cover the preceding month's activity. The Contractor shall use the MWSBE Contract Compliance and Monitoring System (B2G Now) to meet this requirement.
2. Contractor shall maintain the following records for review upon request by the OBO Director or Contracting Department:
 - a. Copies of executed Subcontractor agreements and purchase orders;
 - b. Documentation of payments and other transactions with MWSBE Subcontractors/ Suppliers;
 - c. Appropriate explanations of any changes or replacements of MWSBE Subcontractors/Suppliers;

NOTE: All replacement MWSBE Subcontractors/Suppliers must be certified by the Office of Business Opportunity.

- d. Any other records required by the OBO Director or Contracting Department.
3. If a Participation Plan Percentage is not being met, the monthly report shall include a narrative description of the progress being made in MWSBE participation. If sufficient MWSBE Subcontractors or Suppliers to meet the Participation Plan Percentage are being utilized, they should be identified by name and the dollar amount paid to date for work performed or materials furnished by each MWSBE during the monthly period. Reports are required when no activity has occurred in a monthly period.
4. Contractor shall retain all such records for a period of four years following completion of the Work and shall be available at reasonable times and places for inspection by authorized representatives of the City including the City Controller.

IV. SANCTIONS:

A. SUSPENSION PERIOD AND WAIVER

Pursuant to Section 15-86 of the Code of Ordinances, the OBO Director is authorized to suspend for a period of up to, but not to exceed, five years, any Contractor who has failed to make Good Faith Efforts.

B. GUIDELINES FOR IMPOSITION OF SANCTIONS

1. General:

- a. The OBO Director shall not impose any sanction except upon evidence of specific conduct on the part of a MWSBE or Contractor that is inconsistent with or in direct contravention of specific applicable requirements for Good Faith Efforts.
- b. Imposition and enforcement of suspensions shall be consistent with applicable state law.

2. Severity of Sanctions:

- a. In determining the length of any suspension, the OBO Director shall consider the following factors:
 - (1) Whether the failure to comply with applicable requirements involved intentional conduct or, alternatively, may be reasonably concluded to have resulted from a misunderstanding on the part of the Contractor or MWSBE of the duties imposed on them by Article V of Chapter 15 of the Code of Ordinances and these procedures;
 - (2) The number of specific incidences of failure by Contractor or MWSBE to comply;
 - (3) Whether the Contractor or MWSBE has been previously suspended;
 - (4) Whether the Contractor or MWSBE has failed or refused to provide the OBO Director with any information requested by the Director or required to be submitted to the Director pursuant to law or these procedures;
 - (5) Whether the Contractor or MWSBE has materially misrepresented any applicable facts in any filing or communication to the OBO Director; and
 - (6) Whether any subsequent restructuring of the subject business or other action has been undertaken to cure the deficiencies in meeting applicable requirements.
- b. Suspensions may be for any length of time not to exceed five years. Suspensions in excess of one year shall be reserved for cases involving intentional or fraudulent misrepresentation or concealment of material facts, multiple acts in contravention of applicable requirements, cases where the Contractor or MWSBE has been previously suspended, or other similarly egregious conduct.

C. DELEGATION

A decision to implement a suspension may be taken after notice and an opportunity for a hearing by an impartial person(s) designated by the OBO Director as the hearing officer.

The hearing officer(s) shall not have participated in the actions or investigations giving rise to the suspension hearing.

D. NOTICE

1. Prior to imposing any suspension, the OBO Director shall deliver written notice to the Contractor or MWSBE setting forth the grounds for the proposed suspension and setting a date, time, and place to appear before the hearing officer(s) for a hearing on the matter.
2. Any notice required or permitted to be given hereunder to any Contractor or MWSBE may be given either by personal delivery or by certified United States mail, postage prepaid, return receipt requested, addressed to their most recent address as specified in the records of the Office of Business Opportunity or in the Contract if no address is on file with the Office of Business Opportunity.

E. HEARING PROCEDURES

Proceedings before a hearing officer shall be conducted informally and in accordance with the OBO Policy and Procedures Manual, as amended, provided that each party may be represented by counsel and may present evidence and cross-examine witnesses. The City shall have the burden to prove by a preponderance of evidence that the Contractor's or MWSBE firm's actions constitute misconduct or failure to make Good Faith Efforts. The decision shall be reduced to writing and notice provided to the Contractor or MWSBE.

F. APPEALS

Appeals authorized pursuant to Section 15-86(b) of the Code of Ordinances shall be conducted by the OBO Director. Pursuant to Section 15-86(b), The contractor may appeal the OBO Director's decision in accordance with Section 15-23 of the Code of Ordinances and OBO Policy and Procedures.

ATTACHMENT A

City of Houston
Office of Business Opportunity
Good Faith Efforts Policy

General Policy.

Good Faith Efforts are steps taken to achieve an Contract Goal or other requirements which, by their scope, intensity and usefulness demonstrates the bidder's responsiveness to fulfill the business opportunity objective prior to the award of a contract, as well as the contractor's responsibility to put forth measures to meet or exceed the Contract Goal throughout the duration of the contract.

Good Faith Efforts are required to be made and demonstrated by an apparent successful bidder on goal oriented contracts or proposer on a regulated contract prior to award of a contract. Good Faith Efforts are required on professional services and construction contracts and on procurement of goods and non-professional service contracts with goals. If a bidder, when submitting a participation plan at the time of bid or proposal submission, anticipates it cannot or will not meet the Contract Goal prior to the award, the bidder must demonstrate to Office of Business Opportunity ("OBO") it has made Good Faith Efforts to meet the Contract Goal, to be eligible for the contract award.

Good Faith Efforts shall be evaluated on a case-by-case basis in making a determination whether a bidder or contractor is in compliance with this policy. The efforts employed by a bidder or contractor should be those that one could reasonably expect a bidder or contractor to take if the bidder were actively and aggressively attempting to obtain MWSBE participation sufficient to meet the Contract Goal. Efforts taken that are mere formalities or other perfunctory acts shall not be considered Good Faith Efforts to meet Contract Goals.

The factors provided herein are representative of the types of actions OBO will consider in determining whether the bidder or contractor made Good Faith Efforts to obtain MWSBE participation to meet the Contract Goal. The factors prescribed below are not intended to be a mandatory checklist, nor is it intended to be exhaustive or exclusive. OBO may consider other factors or types of efforts that may be relevant in appropriate cases.

If a contractor fails to submit Good Faith Efforts documentation as provided in this Policy, it waives the right to appeal OBO decisions related to this Policy. OBO will review all the efforts made by the contractor, including the quality and quantity of those efforts.

Pre-Award.

A bidder must submit a participation plan (Document 00470) to OBO at the time the bidder submits the bid. If the participation by certified MWSBE subcontractors documented on the participation plan ("participation") is less than the Contract Goal, a bidder should submit a Record of Good Faith Efforts (Document 00471) with the bid. A bidder should also submit a request for a deviation (Document 00472) if the bidder, having used Good Faith Efforts, reasonably believes that it cannot meet the Contract Goal or a commercially useful deviation.

In making a determination that the bidder has made a good faith effort to meet the Contract Goals, OBO shall consider specific documentation concerning the steps taken to obtain MWSBE participation, with a consideration of, by way of illustration and not limitation, whether the bidder demonstrated a genuine effort to comply with the following factors:

1. Attended any pre-bid or pre-proposal meetings scheduled by the City Department;
2. Followed up with MWSBEs that attended the pre-bid or pre-proposal meetings to discuss subcontracting and supplier opportunities and contacted MWSBEs listed in the City's online directory;
3. Conducted outreach with minority and women focused organizations and associations far in advance of solicitation due date (no less than 10 business days);
4. Identified and designated portions of the work to be performed by MWSBEs to increase the likelihood of meeting the Contract Goals (including where appropriate breaking down the contract into reasonably sized subcontracts to ensure participation);
5. Advertised subcontracting opportunities in news media focused towards minority and women persons far in advance of solicitation due date;
6. Provided MWSBEs with a point of contact that was knowledgeable about the project and possessed decision-making authority to answer questions from interested MWSBEs;
7. Provided a reasonable number of MWSBEs certified with timely written notices via email, mail, and/or fax and/or with documented contact regarding the subcontracting/supplier opportunities. A "reasonable number of MWSBEs" shall be based on the number of MWSBEs available in the directory;
8. Solicited the MWSBEs within a reasonable amount of time (no less than seven business days) before bid submission, as well as followed up with the MWSBEs solicited to determine if they were interested in submitting a bid or proposal or participating on a team.

9. Provided interested MWSBEs certified to perform the solicited work with prompt access to the plans, specifications, scope of work and requirements of the contract;
10. Negotiated in good faith with interested MWSBEs, and not rejecting MWSBEs as unqualified without sound reasons based on a thorough investigation of their capabilities;
11. Entered into a formal contract, or signing enforceable letters of intent with MWSBEs;
12. Provided an explanation to any MWSBE whose bid or price quotation is rejected, unless another MWSBE is accepted for the same work, as follows:
 - a. Where price competitiveness is not the reason for rejection, a written rejection notice including the reason for rejection will be sent to the rejected MWSBE firm;
 - b. Where price competitiveness is the reason for rejection, a meeting must be held with the price-rejected MWSBE, if requested, to discuss the rejection;
13. Made efforts to assist interested MWSBEs in obtaining bonding, lines of credit, insurance required for the contract, and documenting MWSBE denied by bona fide surety agents;
14. Ensured that the conditions and requirements for subcontracts are commensurate with industry standards and would not cause an economic hardship on MWSBEs, such as unnecessary insurance or coupling bid bonds with retainage;
15. Incorporated efforts not attempted earlier or on previous bids that appear more likely to lead to attaining the Contract Goal. Past performance on similar contracts with similar scopes will also be taken in consideration when determining Good Faith Efforts. A bidder that continues to make same efforts without any significant change in the level of participation may not be making Good Faith Efforts.

Post-Award.

The contractor must sign the approved participation plan (Document 00470 or Document 00570) prior to starting work on the Project. A contractor should submit a request for deviation (Document 00572) from OBO if the contractor, having made Good Faith Efforts, reasonably believes that it will not achieve the Participation Plan Percentage documented in the approved participation plan. Unless OBO approves a deviation, a contractor must submit to OBO a Participation Summary (Document 00660) prior to City Council's consideration of any close-out, term extension, or change order. If participation is less than anticipated in the approved participation plan, the contractor must submit a Record of Good Faith Efforts (Document 00571) along with the Participation Summary. A contractor that fails to submit a deviation request and Good Faith Efforts documentation waives the right to appeal OBO decisions related to this Policy.

If the contractor is awarded the contract and fails to achieve the established Participation Plan Percentage, the contractor must demonstrate to OBO its efforts to meet the Participation Plan Percentage and failure to do so based on circumstances that the contractor could not reasonably control. In determining whether the contractor made Good Faith Efforts to ensure full participation and achievement of the Participation Plan Percentage, OBO shall consider the following factors:

1. Whether the contractor designated an MWSBE liaison officer to administer the Contractor's MWSBE programs and to be responsible for maintenance of records of Good Faith Efforts.
2. Whether the contractor furnished prompt MWSBE Utilization Reports in a timely and accurate manner through the online Contract Monitoring System or via hard copy.
3. Whether the contractor responded to efforts to resolve disputes with MWSBEs, and genuinely attempted to resolve these issues.
4. Whether the contractor disclosed payment discrepancies timely and within the monthly reporting period;
5. Whether the contractor complied with the participation plan, unless the contractor received a deviation from the OBO Director and whether upon approval, the contractor made Good Faith Efforts to replace a removed MWSBE with another certified firm;
6. Whether the contractor furnished prompt written responses to written inquiries from the Director or any employee of OBO regarding the MWSBE's performance or information germane to the MWSBE's certification;
7. Whether the contractor ensured that at all times during the performance of any contract or subcontract the MWSBE firm is engaging in a commercially useful function as that term is defined in Chapter 15 of the City of Houston Code of Ordinances;
8. Whether the contractor provided the OBO information, or other material, that was factually accurate and free of material misrepresentation; and

9. Whether the contractor furnished prompt responses to requests for information, books and records needed to verify compliance from the department administering the Contract, the City Attorney and the City Controller;
10. Whether the contractor attended all meetings and mediation hearings as requested by the Director or his/her designee; and
11. How the contractor may be affected by change orders, with consideration given to the size of the change orders.

Change Orders.

The requirement to make Good Faith Efforts to achieve the approved Participation Plan Percentage is applicable to change orders. Contractors should make Good Faith Efforts to ensure that the Participation Plan Percentage remains substantially the same after the issuance of change orders. If a contractor cannot maintain substantially the same level of participation provided in the latest approved Participation Plan (Document 00470 or Document 00570) due to a change order, the contractor shall submit to the OBO Director and Contracting Department a Document 00571 (Post-Award Record of Good Faith Efforts) and Document 00572 (Post-Award Plan Deviation Request) in a timely manner that does not cause disruption to the project. In addition to other relevant factors, in evaluating whether Good Faith Efforts were made by the contractor to meet the Participation Plan Percentage despite change orders, the OBO Director shall consider the contractor's efforts to timely and efficiently deliver the project.

END OF DOCUMENT

Document 00820

**WAGE SCALE AND PAYROLL REQUIREMENTS FOR ENGINEERING
CONSTRUCTION**

Wage Scale Requirements

- 1.1 Contractor and its Subcontractors must pay the general prevailing wage rates for building construction for each craft or type of worker or mechanic employed in the execution of any building construction or repair under the Contract in accordance with Chapter 2258 of the Texas Government Code and City of Houston, Texas Ordinance Nos. 85-2070, 2000-1114, 2001-152, 2006-91 and 2006-168, and 2009- 247 all as amended from time to time. City Council has determined the prevailing wage rate in the locality in which the work is being performed, which is set forth in Exhibit "A".
- 1.2 This prevailing wage rate does not prohibit the payment of more than the rates stated.
- 1.3 In bidding, Contractor warrants and represents that it has carefully examined the classifications for each craft or type of worker needed to execute the Contract and determined that such classifications in Exhibit "A" include all necessary categories to perform the work under the Contract.
- 1.4 The wage scale for engineering construction is to be applied to all site work greater than five feet from an exterior wall of new building under construction or from an exterior wall of an existing building.
- 1.5 If Contractor believes that an additional classification for a particular craft or type of worker is necessary to perform work under the Contract, it must submit with its bid a request to the Contract Compliance Division of the Office Of Business Opportunity ("OBO") to use an additional labor classification not listed in Exhibit "A" and specify the proposed new classification. OBO shall determine whether a proposed classification is already covered in Exhibit "A", and, if it is, specify which classification is appropriate. OBO's decision is conclusive. If OBO decides that a new classification is necessary, it will determine the appropriate prevailing wage rate for any resurveyed, amended, new, or additional craft or type of worker not covered by Exhibit "A". Such determination must be decided in accordance with procedures established by OBO, and in compliance with Chapter 2258 of the Texas Government Code and City of Houston, Texas Ordinance Nos. 85-2070, 2000-1114, 2001-152, 2006-91, 2006-168 and 2009-247 subject to City Council approval.
- 1.6 Contractor must not use any labor classification not covered by Exhibit "A" until such classification is established and approved for use by OBO.
- 1.7 A Contractor or Subcontractor who violates Chapter 2258 of the Texas Government Code must pay to the City, \$60 per each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates set forth in Exhibit "A".

- 1.8 The City may withhold money required to be withheld under Chapter 2258 of the Texas Government Code from the final payment to Contractor or earlier payments if City Council makes a determination that there is good cause to believe that Contractor has not complied with these provisions and Chapter 2258 of the Government Code, in which case the City may withhold the money at any time subsequent to the finding by City Council.
- 1.9 Contractor and Subcontractors must keep records specifying:
- (1) the name and classification of each worker employed under the Contract; and
 - (2) the actual per diem wages paid to each worker, and the applicable hourly rate.
- The records must be open at all reasonable hours for inspection by the officers and agents of the City.
- 1.10 The hourly cost of salary for non-exempt workers for labor in excess of 40 hours per worker per week, shall be calculated at 1.5 times the worker's base pay, plus 1.0 times fringe benefits, for the applicable craft and level.

Certified Payroll Requirements

- 2.1 Employees are paid weekly and payrolls are submitted weekly using the City of Houston's electronic payroll submission module, unless the prime Contractor has been instructed to do otherwise by the Office of Business Opportunity. When no work is done after a Contractor has started work, the Contractor is required to submit a weekly compliance statement indicating no work was performed. The payrolls must reflect the exact work and classification of the workers, the exact amount that they were paid. Workers must be paid the contracted amount (prevailing wage rates). The Contractor will be penalized \$60.00 a day for each employee who is underpaid per Texas Government Code §2258-023 for all contracts.
- 2.2 Payrolls must be submitted electronically & indicate whether the worker worked inside or outside the building area when both wage rates are applicable to the contract.
- 2.3 Payrolls must be submitted each week until all work by the contractor is complete and the electronic payroll submission is marked as final in the system.
- 2.4 Payrolls must cover a seven day period from the start of the work week and must be consecutive seven day periods until all work is complete.
- 2.5 Payrolls must have employees' names, addresses, last four digits of the social security numbers, and job classifications. The job classifications must be the same as the classifications on the prevailing wage rate schedule.
- 2.6 A payroll deduction authorization form must be submitted for each employee for any deductions other than Federal and FICA taxes.
- 2.7 Employees must be paid overtime (time and a half) for all hours worked over 40 hours a week on both federally and City-funded contracts.

- 2.8 The Contractor has the responsibility to comply with all Internal Revenue Service rules and regulations. Contractors who submit certified payrolls with **Owner Operators (truckers)** must submit a signed tax liability statement from Owner Operator acknowledging their responsibility for Federal Income Tax and FICA reporting obligations.
- 2.9 If the Contractor wants to use the apprentice wage rates for an employee, the apprenticeship certificates must be submitted to the Office of Business Opportunity in advance of the employee working on the project and appearing on the payroll. You must comply with the listed number of journeymen to apprentices as listed.
- 2.10 A poster of the Prevailing Wage Rate Schedule should be clearly displayed on each job site from the time the project starts until the work is completed, or in case of annual service agreements, in the Contractor's office.
- 2.11 The Contractor shall submit the "Certificate from Contractor Appointing Officer or Employee to Supervise Payment of Employees" (Exhibit "B") to the Monitoring Authority listed in Document 00495 prior to final execution of the contract.
- 2.12 During the course of the work, ALL Subcontractors shall submit the "Certificate from Subcontractor Appointing Officer or Employee to Supervise Payment of Employees" (Exhibit "C") to the Monitoring Authority listed in Document 00495.
- 2.13 Upon completion of the Project, as part of the contract-awarding department's total clearance process, the Office of Business Opportunity's Contract Compliance Section must review whether the Wage Rate and Payroll Requirements were met and report the results to the department.

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EXHIBIT "A"

LABOR CLASSIFICATIONS AND PREVAILING WAGE RATES FOR
ENGINEERING CONSTRUCTION 2015

CLASSIFICATION	RATE	CLASSIFICATION	RATE
Asphalt Distributor Operator	\$14.06	Milling Machine Operator - Fine Grade	\$13.53
Asphalt Paving Machine Operator	\$14.32	Mixer Operator	\$10.33
Asphalt Raker	\$12.36	Motor Grader Operator- Rough	\$14.23
Asphalt. Shoveler	\$11.68	Motor Grader Operator	\$15.69
Broom or Sweeper Operator	\$12.68	Oiler	\$12.12
Bulldozer Operator	\$11.81	Painter-Structures	\$18.62
Carpenter- Rough	\$12.49	Pavement Marking Machine Operator	\$11.18
Concrete Finisher- Paving	\$12.98	Pile Driver	\$14.95
Concrete Finisher- Structures	\$12.98	Pipe Layer	\$12.12
Concrete Paving Curbing Machine Operator	\$11.71	Reinforcing Steel Setter - Paving	\$15.15
Concrete Paving Finishing Machine Operator	\$13.07	Reinforcing Steel Setter - Structure	\$14.39
Concrete Paving Joint Sealer Operator	\$11.00	Roller Operator, Pneumatic - Self-propelled	\$11.57
Concrete Paving. Saw Operator	\$13.99	Roller Operator, Steel Wheel, Flat Wheel/Tamping	\$11.57
Concrete Paving Spreader Operator.	\$10.44	Roller Operator, Steel Wheel, Plant Mix Pavement	\$11.92
Concrete Rubber . . .	\$9.00	Scraper Operator	\$13.47
Crane Clamshell Backhoe Derrick, Dragline, Shovel Operator	\$12.71	Servicer	\$13.97
Crusher and Screening Plant Operator	\$11.29	Sign Installer - PGM	\$8.54
Electrician * 3 Journeyman 2 Apprentice Allowed	\$27.11	Slip Form Machine Operator	\$11.07
Flagger	\$10.33	Spreader Box Operator	\$13.58
Form Builder/Setter- Structures	\$12.23	Structural Steel Worker	\$14.39
Form Liner- Paving and Curb	\$12.34	Tractor Operator - Crawler Type	\$13.68
Form Setter- Paving and Curb	\$12.34	Tractor Operator- Pneumatic	\$10.07
Foundation Drill Operator - Crawler Mounted	\$17.43	Transit Mixer Truck Driver	\$11.00
Foundation Drill Operator - Truck Mounted	\$15.89	Truck Driver, Lowboy-float	\$16.03
Front Loader Operator	\$13.17	Truck Driver, Single-Axle - Heavy	\$11.46
Laborer Common	\$11.02	Truck Driver, Single-Axle - Light	\$11.48
Laborer- Utility	\$11.73	Truck Driver, Tandem Axle Semi-Trailer	\$12.27
Manhole Builder	\$9.00	Work Zone Barricade Servicer	\$11.67
Mechanic	\$16.96	Receive rate prescribed for craft performing operation to which welding is incidental	
* Apprentices- must be in an approved USDOL Program and cannot exceed ratios			

Engineering Prevailing Wages Classification Definitions

Asphalt Distributor Operator

Drives distributor truck, sets spray bars and operates valves and levers to control distribution of bituminous material for highway surfacing. May oil, grease or otherwise service and make adjustments to equipment as needed. Performs other related duties.

Asphalt Paving Machine Operator

Operates paving machine that spreads and levels asphaltic concrete on highway subgrade. Controls movement of machine, raises and lowers screed, regulates width of screed. May, oil, grease, service and make adjustments to equipment as needed. Performs other related duties.

Asphalt Raker

Distributes asphaltic materials evenly over road surface by raking and brushing material to correct thickness; directs Laborers when to add or take away material to fill low spots or to reduce high spots. Performs other related duties.

Asphalt Shoveler

A general term used on construction work covering many unskilled classifications requiring work of a physical nature. A laborer works with all crews doing everything from pick and shovel work to cleaning up lumber with hammer, shoveling and placing concrete, uses air tools, cleans concrete joints and fills joints with sealing compound from bucket or with hose and nozzle from a central source, applies coating of oil to inside face of forms, may help set and strip forms, unloads and transports reinforcing steel, cures newly poured concrete, helps lower pipe into ditch for pipelayers, builds fences, works with dirt crew keeping construction layout stakes out of the way of dirt moving equipment.

Broom or Sweeper Operator

Operates a self-propelled machine to sweep and clean roadway surfaces. May oil grease, service and make adjustments to equipment as needed. Performs other related duties.

Bulldozer Operator

Operates a crawler tractor with a bulldozer mounted in front of chassis to level, distribute and push earth or other material. May operate a ripper attachment to break up rock or other hard material. May use a push block on front of tractor to push load scrapers. May oil, grease, or otherwise service and make minor repairs to equipment as needed. Performs other related duties.

Carpenter, Rough

Works from plans to build, assemble, fit together, align, plum, and set in place forms for molding concrete structures. Forms may be wood, steel, aluminum, fiberglass or any other type of material. Checks form while concrete is placed. May install miscellaneous materials integral to concrete structures. May set precast concrete elements. Prepares for slipforming traffic rail and median barrier. May install permanent metal deck forms. May work with power tools Performs other related duties.

Concrete Finisher, Paving

Finishes the exposed surfaces of fresh concrete paving, median barrier and every element of concrete structures to the final grade and contour structures to the final grade and contour with the use of straight edges and steel trowels. Operates bridge deck finishing machine. Finishes concrete curbs and gutters. Finishes exposed surface of concrete after forms have been removed by patching imperfections with fresh concrete, rubbing surface with abrasive stone, and directing others in removing excess or defective concrete with power tools. Performs other related duties.

Concrete Finisher, Structures

A worker semi-skilled in concrete finishing who assists Concrete finisher by performing specific or general duties of lesser skill and keeping Concrete Finisher supplied with materials, tools, and supplies; cleaning working area an equipment; and holding materials and tools. Performs other related duties.

Concrete Paving Curbing Machine Operator

Operates self - propelled machine(s) which may or may not travel on concrete paving forms, spreading and leveling fresh concrete to grade by use of augers and screeds. May oil, grease or otherwise service and make adjustments to equipment as necessary. Performs other related duties.

Concrete Paving Finishing Machine Operator

Operates self - propelled machine(s) which may or may not travel on concrete paving forms, spreading and leveling fresh

concrete to grade by use of augers and screeds. May oil, grease or otherwise service and make adjustments to equipment as necessary. Performs other related duties.

Concrete Paving Joint Sealer Operator

Cleans and seals joints requiring a hot or cold sealing compound in concrete paving, sidewalks, driveway and approach slabs. May oil, grease or make necessary repairs adjustments to equipment as needed. Performs other related duties.

Concrete Paving Saw Operator

Operates a water-cooled power saw with either or an abrasive blade to saw expansion and contraction joints in concrete paving. May also be used to saw asphaltic pavements. May oil grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Concrete Paving Spreader Operator

Operates self - propelled machine(s) which may or may not travel on concrete paving forms, spreading and leveling fresh concrete to grade by use of augers and screeds. May oil, grease or otherwise service and make adjustments to equipment as necessary. Performs other related duties.

Concrete Rubber

Finishes the exposed surface of concrete masonry after the forms have been removed by patching holes and broken corners with fresh concrete, rubbing surface with abrasive stone to remove rough spots, and removing high spots and defective concrete with hand chisel and hammer or pneumatic chisel and powered abrasive stone. Performs other related duties.

Crane, Clamshell, Backhoe, Derrick, Dragline, Shovel Operator

A worker who operates a lattice boom type crane can hoist and move materials, raise and lower heavy weights and perform other related operations. May be crawler type or rubber tired. May include placement of rock riprap, clamshell, dragline, pipe and pile driving operations. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Crusher and Screed Plant Operator

Operates a crusher or screening plant through which rock is run to break it into crushed stone for construction or to control flow of materials not needed. May include minor repairs and may service and make necessary adjustments to equipment as needed. Performs other related duties.

Electrician *3 Journeyman 2 Apprentice

Plans and directs the layout of metal electrical conduit, installs wiring systems, switch-panels, buss bars, works on overhead distribution systems and underground distribution systems. Performs other related duties.

Flagger

A worker who directs traffic in or around a construction site. May use signs or devices to direct traffic. May help assemble, position and clean devices or equipment used to direct traffic. Must be able to effectively communicate with the public. May require certain level of training by TXDOT specifications. Performs other related duties.

Form Builder/Setter, Structures

Fits together, aligns and sets to grade metal and wooden forms for placement of concrete. Forms may be wood, steel, aluminum, fiberglass or any other type of material. Checks forms while concrete is placed. May install miscellaneous materials integral to concrete structures. May set precast concrete elements. Prepares for slipforming traffic rail and median barrier. May install permanent metal deck forms. May work with power tools. Performs other related duties.

Form Liner, Paving & Curb

Fits together, panels align and sets to grade metal and wooden forms for placement of concrete. Works with survey crew to set stringline for panels or moles. Performs other related duties.

Form Setter, Paving & Curb

Fits together, align and set to grade metal and wooden forms for placement of concrete paving and curbs. Works with survey crew to set stringline for paving, curb and gutter curb. Performs other related duties.

Foundation Drill Operator, Crawler Mounted

Operates a hole-drilling machine that is crawler mounted. May include geotechnical operations such as soils nails, rock nails, tiebacks, anchors and jet grouting. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Foundation Drill Operator, Truck Mounted

Operates a hole drilling machine that is mounted on the rear of a rubber tired vehicle or truck. May include soils nails, rock nails, tiebacks, anchors and jet grouting. Drive truck from location to location or may have laborer who drives truck. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Front End Loader Operator

Operates a rubber tired, skid steer or crawler type tractor with an attached scoop type bucket on front end. Machine is used to load materials from stockpiles, excavation, charging batch plants, loading and unloading trucks. May be used with attachments in lieu of the bucket. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Laborer, Common

A general term used on construction work covering many unskilled classifications requiring work of a physical nature. A laborer works with all crews doing everything from pick and shovel work to cleaning up lumber with hammer, shoveling and placing concrete, uses air tools, cleans concrete joints and fills joints with sealing compound from bucket or with hose and nozzle from a central source, applies coating of oil to inside face of forms, may help set and strip forms, unloads and transports reinforcing steel, cures newly poured concrete, helps lower pipe into ditch for pipelayers, builds fences, works with dirt crew keeping construction layout stakes out of the way of dirt moving equipment.

Laborer, Utility

Performs a variety of manual duties, usually working in a utility capacity by working on multiple projects and tasks where demands require workmen with varied experience and ability to work without close direction. Unloads and transports reinforcing steel. May occasionally place and tie reinforcing steel. Directs common laborers in pouring concrete. Erects shoring and bracing. Assists in installation of pipe. Installs, operate and maintains dewatering systems. May assist equipment operators in positioning machines, verifying grades and signaling operators. Directs truck drivers and scraper operators to dumping positions to maintain grades as directed. Uses power tools and air tools. May work as lead man in a labor crew. His performance of a wide variety of construction jobs distinguishes him from a helper assigned to a specific craft. Installs and maintains erosion control. Is more or less a general utility construction worker. May be second step in learning a skill, and may later become a helper in a specific classification. Performs other related duties.

Manhole Builder

Constructs a means of permanent access to water and sewer lines for maintenance purposes. This work consists of laying brick or concrete slab at bottom of ditch up to an approximate grade line near the surface of the ground. Brick or block is normally laid to form a nearly circular manhole. Brick or block is laid in by eyesight and is normally to a plumb line. Chipped or culled brick can be used quite often is. No effort may be made to keep mortar off the face of the brick and joints are not pointed. May apply coating of concrete to interior and exterior surface. Performs other related duties.

Mechanic

Assembles, set up, adjusts and maintains and repairs all types of construction equipment and trucks. He may perform the duties of a welder in repair of equipment. Performs other related duties.

Milling Machine Operator, Fine Grade

Operates a power-driven milling machine that planes material of the to roadbed and discharges the material into a hauling unit or a windrow. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Mixer Operator

Performs a variety of manual duties, usually working in a utility capacity by working on multiple projects and tasks where demands require workmen with varied experience and ability to work without close direction. Unloads and transports reinforcing steel. May occasionally place and tie reinforcing steel. Directs common laborers in pouring concrete. Erects shoring and bracing. Assists in installation of pipe. Installs, operate and maintains dewatering systems. May assist equipment operators in positioning machines, verifying grades and signaling operators. Directs truck drivers and scraper operators to dumping positions to maintain grades as directed. Uses power tools and air tools. May work as lead man in a labor crew. His performance of a wide variety of construction jobs distinguishes him from a helper assigned to a specific craft. Installs and maintains erosion control. Is more or less a general utility construction worker. May be second step in learning a skill, and may later become a helper in a specific classification. Performs other related duties.

Motor Grader Operator, Rough

Operates a motor grader. Equipment is used to grade excavation and embankment and to lay asphalt, base and other materials. May blade haul roads and do other general motor grader work, but does not perform finish grade work to close

specification tolerances. This operator may be a learner in the first phase of learning the skills of motor grader work. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Motor Grader Operator

Operates a motor grader. Equipment is used to grade excavation and embankment and to lay asphalt, base and other materials. May blade haul roads and do other general motor grader work, but does not perform finish grade work to close specification tolerances. This operator may be a learner in the first phase of learning the skills of motor grader work. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Oiler

A learner or semi-skilled worker who under the direction of the watch engineer. May oil and grease or otherwise service all engines and necessary equipment as needed. He may clean and paint engine room as needed. Performs other related duties.

Painter, Structures

Paints and stains structural steel and concrete surfaces of bridges, retaining walls, or other structures. Directs cleaning and abrasive blasting of surfaces prior to painting or staining. Performs other related duties.

Pavement Marking Machine Operator

Operates machine used in laying paint stripes or markers on all types of paving. Loads machine with appropriate materials and may walk or ride on machine. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Piledriverman

Sets in place, aligns, plumbs directs driving of timber, concrete, steel, pipe and any other type of piling. Sets, drives and pulls steel, concrete and other types of sheet piling. Rigs pile and leads and bracing. Signals operator. Splices piles before and after driving. Directs pile cutoff. May direct jetting or drilling equipment in connection with installing piles to grade. Performs other related duties.

Pipelayer

Installs concrete, clay, steel, ductile iron, plastic, corrugated pipe and any other type of pipe for storm drainage, water lines, gas lines and sanitary sewer lines. Lays underground communication and electrical ducts. May install and set electrical ground boxes, hand holes, manholes, inlets and other structures. Caulks joints, makes threaded and flanged connections. Installs valves and other accessories. Performs other related duties.

Reinforcing Steel Setter, Paving

Works from plans to lay out and install reinforcing steel within forms or in mats of concrete paving. May direct unloading of material. Determines rigging required to complete work. Gives direction to reinforcing steel worker (helper) or common or utility laborers. May install miscellaneous materials integral to concrete structure or paving. May work with power tools. Performs other related duties.

Reinforcing Steel Setter, Structure

Works from plans to lay out and install reinforcing steel within forms or in mats of concrete paving. May direct unloading of material. Determines rigging required to complete work. Gives direction to reinforcing steel worker (helper) or common or utility laborers. May install miscellaneous materials integral to concrete structure or paving. May work with power tools. Performs other related duties.

Roller Operator, Pneumatic, Self-Propelled

Operates a self-propelled machine with either steel wheels pneumatic tires, which is used to compact and smooth all bituminous materials. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Roller Operator, Steel Wheel, Flat Wheel/Tamping

Operates a self-propelled machine with either steel wheels or pneumatic tires which is used to compact earth fills, subgrade, flexible base and all other types of materials except bituminous. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Roller Operator, Steel Wheel, Plant Mix Pavement

Operates a self-propelled machine with either steel wheels pneumatic tires, which is used to compact and smooth all bituminous materials. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Scraper Operator

Operates a self-contained wheeled tractor scraper both self loading or assisted by crawler tractors or other scrapers. Used to excavate and transport earth or other materials. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Servicer

Drives a truck, which carries various fuels, oils, greases and filters. Must have knowledge of and is responsible for the correct oiling and greasing and changing of filters on equipment according to the manufacturers' specifications. Uses compressed air grease guns, wrenches and other tools. May make adjustments to clutches, brakes and other mechanical items. Keeps record of service preventive maintenance records. May have laborer assisting him. May require CDL if driving truck on public highways. Performs other related duties.

Sign Installer (PGM)

Sets forms, reinforcing steel, anchor bolts and pours concrete for Sign foundations. Fabricates and erects pipe and angle Frameworks by bolting, welding or other means prior to installation of signs that are normally prefabricated. Works from plans in location and drilling holes for proper location and alignment of signs. May direct hoisting of signs into place. Fastens signs to framework by bolting and other means. Locates and sets lighting brackets. May perform other work associated with signing projects. Supervises sign erector helper. Performs other related duties.

Slip Form Machine Operator

Cleans and seals joints requiring a hot or cold sealing compound in concrete paving, sidewalks, driveway and approach slabs. May oil, grease or make necessary repairs adjustments to equipment as needed. Performs other related duties.

Spreader Box operator

Operates spreader box by adjusting hopper and strike off blade so that the gravel, stone or other material may be spread to a specific depth on road surface during seal coat and surface treatment operations. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Structural Steel Worker

Works from plans to lay out and install reinforcing steel within forms or in mats of concrete paving. May direct unloading of material. Determines rigging required to complete work. Gives direction to reinforcing steel worker (helper) or common or utility laborers. May install miscellaneous materials integral to concrete structure or paving. May work with power tools. Performs other related duties.

Tractor operator, Crawler Type

Operates a crawler tractor with a bulldozer mounted in front of chassis to level, distribute and push earth or other material. May operate a ripper attachment to break up rock or other hard material. May use a push block on front of tractor to push load scrapers. May oil, grease, or otherwise service and make minor repairs to equipment as needed. Performs other related duties.

Tractor Operator, Pneumatic

Operates a gasoline or diesel powered agricultural tractor that tows compaction rollers, plow, disc. water tanks, scrapers and other similar operations. May use other miscellaneous attachments. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Traveling Mixer Operator

Drives a gasoline or diesel truck upon which is mounted a concrete mixer. Operates concrete mixer and dumps concrete on the grade, into forms or into concrete pumps or buckets. Cleans mixer drum. May require CDL license for on highway use. May service and make necessary adjustments for proper operation of equipment. Performs other related duties.

Truck driver, lowboy-Float

Drives a heavy-duty diesel powered truck to which is attached a trailer upon which heavy equipment is hauled. Driver is often required to operate heavy equipment to load or unload the lowboy. May require CDL license for on highway use. May service and make necessary adjustments for proper operation of equipment. Performs other related duties.

Truck driver, Single Axle, Heavy

Drive a light capacity truck for transporting loads of construction material. The truck is of single rear axle type, may have various kinds of beds attached, such as dump, flat bed, tank, etc. May require CDL license for driving on highway. May services and make necessary adjustments for proper operation equipment. Performs other related duties.

Truck driver, Single Axle-Light

Drive a light capacity truck for transporting loads of construction material. The truck is of single rear axle type, may have

various kinds of beds attached, such as dump, flat bed, tank, etc. May require CDL license for driving on highway. May service and make necessary adjustments for proper operation equipment. Performs other related duties.

Truck Driver, Tandem Axle, Semi-Trailer

Drives a diesel-powered tractor pulling a semi trailer hauling materials. Hauls dirt, rock, aggregates or other material. May require CDL license for driving on highway. May service and make necessary adjustments for proper operation of equipment. Performs other related duties.

Work Zone Barricade Servicer

Fabricates, erects and maintains temporary traffic control devices, including arrow boards, signs, barricades, channelizing devices, barrels and all message boards. May operate a truck during traffic control operations.

WELDERS - Receives rate for craft being performed to which welding is incidental.

EXHIBIT "B"

CERTIFICATE FROM CONTRACTOR APPOINTING OFFICER OR EMPLOYEE TO
SUPERVISE PAYMENT OF EMPLOYEES

Project Name _____

Project WBS#: _____ Date _____

(I) (We) hereby certify that (I am) (we are) the **Prime Contractor** for _____

_____ (specify type of job)

in connection with construction of the above-mentioned Project, and that (I) (we) have appointed _____, whose signature appears below, to supervise the payment of (my) (our) employees beginning _____, 20____; that he/she is in a position to have full knowledge of the facts set forth in the payroll documents and in the statement of compliance required by the Copeland Act and the City of Houston, which he/she is to execute with (my) (our) full authority and approval until such time as (I) (we) submit to the City of Houston a new certificate appointing some other person for the purposes hereinabove stated.

_____ Phone: _____
(Identifying Signature of Appointee)

Attest: _____
(Name of Firm or Corporation)

By: _____
(Signature)

By: _____
(Signature)

_____ (Title)

_____ (Title)

NOTE: This certificate must be executed by an authorized officer of a corporation or by a member of a partnership, and shall be executed prior to and be submitted with the first payroll. Should the appointee be changed, a new certificate must accompany the first payroll for which the new appointee executes a statement of compliance required by the Copeland Act and the City of Houston.

EXHIBIT "C"

CERTIFICATE FROM SUBCONTRACTOR APPOINTING OFFICER OR EMPLOYEE TO
SUPERVISE PAYMENT OF EMPLOYEES

Project Name _____

Project WBS#: _____ Date _____

(I) (We) hereby certify that (I am) (we are) the **Sub Contractor** for _____

(specify type of job)

in connection with construction of the above-mentioned Project, and that (I) (we) have appointed _____, whose signature appears below, to supervise the payment of (my) (our) employees beginning _____, 20____; that he/she is in a position to have full knowledge of the facts set forth in the payroll documents and in the statement of compliance required by the Copeland Act and the City of Houston, which he/she is to execute with (my) (our) full authority and approval until such time as (I) (we) submit to the City of Houston a new certificate appointing some other person for the purposes hereinabove stated.

(Identifying Signature of Appointee) Phone: _____

Attest: _____
(Name of Firm or Corporation)

By: _____
(Signature)

By: _____
(Signature)

(Title)

(Title)

NOTE: This certificate must be executed by an authorized officer of a corporation or by a member of a partnership, and shall be executed prior to and be submitted with the first payroll. Should the appointee be changed, a new certificate must accompany the first payroll for which the new appointee executes a statement of compliance required by the Copeland Act and the City of Houston.

END OF DOCUMENT

Document 00830

TRENCH SAFETY GEOTECHNICAL INFORMATION

1.0 DOCUMENT INCLUDES

- A. Trench Safety Geotechnical Information: Geotechnical information obtained for use in design of the trench safety system is included as an attachment to this document.

2.0 RELATED DOCUMENTS

- A. Section 02260 - Trench Safety Systems.

END OF DOCUMENT



GEOTEST ENGINEERING, INC.

Geotechnical Engineers & Materials Testing

5600 Bintliff Drive

Houston, Texas 77036

Telephone: (713) 266-0588

Fax: (713) 266-2977

Job No. 1140200501

Trench Safety Report

December 1, 2014

Mr. William C. Rackley, P.E.
Alan Plummer Associates, Inc.
3100 Wilcrest Drive, Suite 270
Houston, Texas 77042

**Reference: Trench Safety Design Considerations
Odor Control Design at 11th Street Facility
WBS No. R-000020-0010-3
Houston, Texas**

Dear Mr. Rackley:

We are pleased to present our geotechnical information for trench safety for the referenced project.

For trench excavation, it is essential to maintain the stability of the sides and base and not to disturb the soil below the excavation grade. This is necessary to prevent any damage to adjacent facilities as a result of either vertical or lateral movements of the soil. In addition, a satisfactory excavation procedure must include an adequate construction dewatering system to lower and maintain the water level at least 3 feet below the lowest excavation grade or a minimum of 5 feet below prevailing level of backfill during backfilling. This will minimize the potential for softening or "boiling" of the base support soil.

Trench Stability. For trench excavation, it is essential to maintain the stability of the sides and base and not to disturb the soil below the excavation grade. This is necessary to prevent any damage to adjacent facilities as a result of either vertical or lateral movements of the soil. In addition, a satisfactory excavation procedure must include an adequate construction dewatering system to lower and maintain the water level at least 3 to 5 feet below the lowest excavation grade. This will minimize the potential for softening or "boiling" of the base support soil.

The trench excavation may be shored, laid back to a stable slope (as recommended by OSHA) or some other equivalent means used to provide safety for workers and adjacent structures. The excavating and trenching operations should be in accordance with OSHA Standards, OSHA 2207, Subpart P (latest revision).

- Excavation Shallower Than 5 Feet – Protection may not be required when excavations that are less than 5 feet deep and an examination of the ground by a competent person provides no indication of potential cave-in. When any indication of hazardous ground movement or potential cave-in is anticipated during construction, adequate protective system should be provided for all excavation even that excavations are shallower than 5 feet.

- Excavation Deeper Than 5 Feet – Excavations that are deeper than 5 feet (regardless of the type of soil encountered) should be sloped, shored, shielded or provided with some other appropriate means of protection where workers might be exposed to moving ground or cave-ins. The slopes and shoring should be in accordance with OSHA requirements. The following items provide design criteria for trench stability.
 - (i) OSHA Soil Type. Based on the soil conditions revealed by the geotechnical borings, OSHA's soil type "C" should be used for the determination of allowable maximum slope and/or the design of a shoring system. For shoring deeper than 20 feet, an engineering evaluation is required.

 - (ii) Trench Support Earth Pressure. Trench support earth pressure diagram was developed based on the subsurface conditions indicated by our field and laboratory investigations. The earth pressure diagram developed for trench support is presented on Figure 1. The pressure diagram can be used for the design of temporary trench bracing. Design of trench boxes for resisting lateral earth pressures can be based on an equivalent fluid pressure of 91 pcf. The effects of any surcharge loads at the ground

surface should be added to the computed lateral earth pressures. A surcharge load, q , will typically result in a lateral load equal to $0.5q$. The computation of the equivalent fluid pressure assumes that water level is at ground surface, since these conditions may exist after a heavy rain or flooding.

- (iii) Bottom Stability. In braced cuts, if tight sheeting is terminated at the base of the cut, the bottom of the excavation can become unstable under certain conditions. The stability of the trench bottom is governed by the shear strength of the soils and by the differential hydrostatic head. For cuts in cohesive soils (such as lean clays) as encountered in all the borings, stability of the bottom can be evaluated in accordance with the procedure outlined on Figure 2.

Lateral Earth Pressure Diagram. The pressure diagram provided on Figure 1 can be used for the design of braced excavation.

Excavation Dewatering. Excavations for the utilities along the proposed alignment may encounter groundwater seepage depending upon groundwater conditions at the time of construction and the location and depth of excavation. For cohesive soils such as lean clay and lean clay with sand as encountered in borings, groundwater may be managed by collection in trench bottom sumps for pumped disposal. It is recommended that the contractor should verify groundwater level at the time of construction and should provide an adequate groundwater control, where required.

Mr. William C. Rackley, P.E.
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Job No. 1140200501
December 1, 2014

We appreciate this opportunity to be of service to you. If you have any questions regarding the report, or if we can be of further service to you, please call us.

Sincerely,
GEOTEST ENGINEERING, INC
TBPE Registration No. F-410



Naresh Kolli, P.E.
Assistant Project Manager



NK\ego

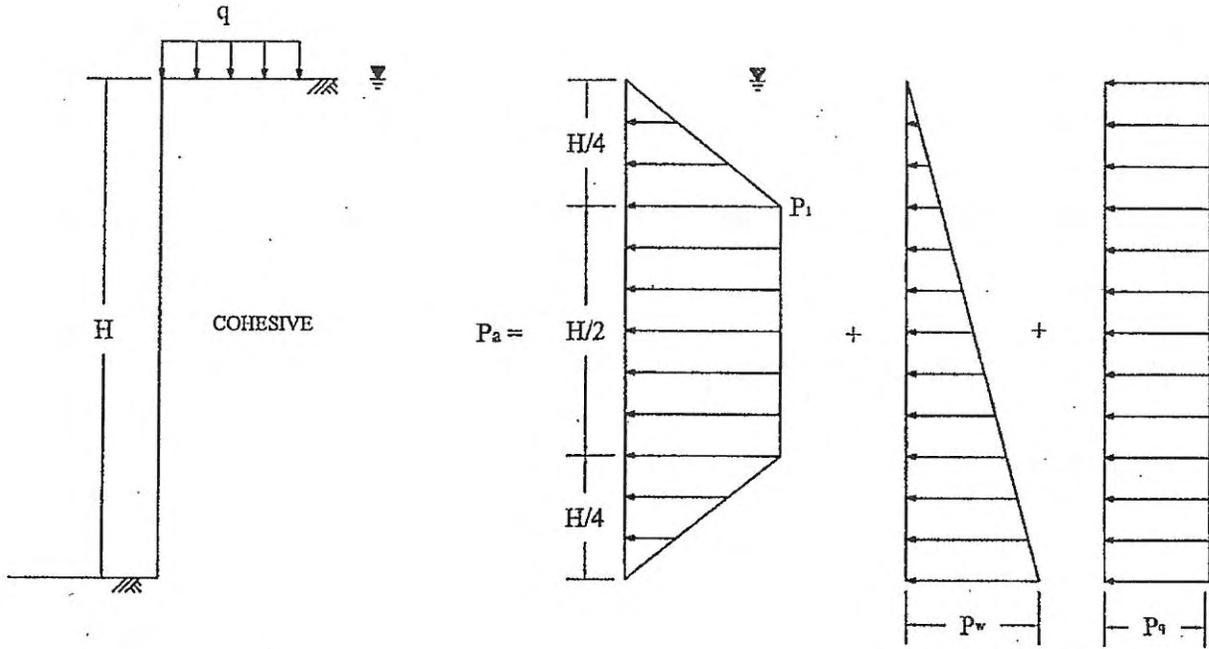
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Enclosures: Trench Support Earth Pressure – Figure 1

Stability of Bottom for Braced Cut – Figure 2

Geotechnical Design Parameter Summary: Open-cut Excavation – Table 1

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TYPICAL SOIL PARAMETERS

See Table 1 for typical values of soil parameters

BRACED WALL

For $\gamma H/c \leq 4$

$$P_1 = 0.3 \gamma' H$$

$$P_w = \gamma_w H = 62.4 H$$

$$P_q = 0.5 q$$

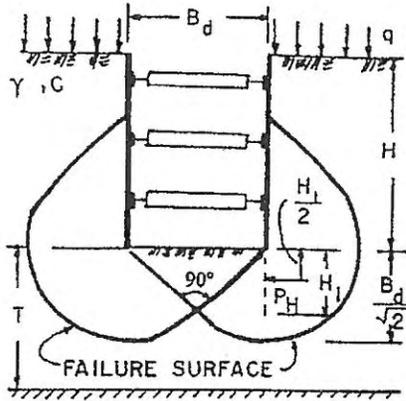
Where:

- γ'_c = Submerged unit weight of cohesive soil, pcf;
- γ_w = Unit weight of water, pcf;
- q = Surcharge load at surface, psf;
- P_a = Lateral pressure, psf;
- P_1 = Active earth pressure, psf;
- P_q = Horizontal pressure due to surcharge, psf;
- P_w = Hydrostatic pressure due to groundwater, psf;
- H = Depth of braced excavation, feet
- c = Shear strength of cohesion soil, psf;

TRENCH SUPPORT EARTH PRESSURE

SUBMERGED COHESIVE SOIL

CUT IN COHESIVE SOIL,
 DEPTH OF COHESIVE SOIL UNLIMITED ($T > 0.7 B_d$)
 L = LENGTH OF CUT



If sheeting terminates at base of cut:

$$\text{Safety factor, } F_s = \frac{N_c C}{\gamma H + q}$$

N_c = Bearing capacity factor, which depends on dimensions of the excavation : B_d , L and H (use N_c from graph below)

C = Undrained shear strength of clay in failure zone beneath and surrounding base of cut

γ = Wet unit weight of soil (see Table 1)

q = Surface surcharge (assumed $q = 500$ psf)

If safety factor is less than 1.5, sheeting or soldier piles must be carried below the base of cut to insure stability - (see note)

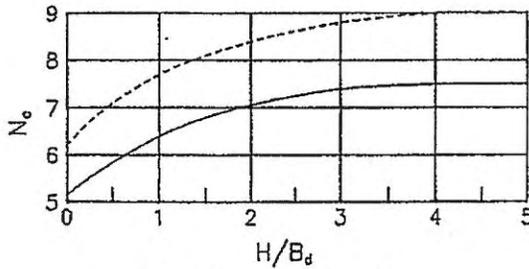
$$H_1 = \text{Buried length} = \frac{B_d}{2} \geq 5 \text{ feet}$$

Note : If soldier piles are used, the center to center spacing should not exceed 3 times the width or diameter of soldier pile .

Force on buried length, P_H :

$$\text{If } H_1 > \frac{2 B_d}{3 \sqrt{2}}, P_H = 0.7 (\gamma H B_d - 1.4CH - \pi C B_d) \text{ in lbs/ linear foot}$$

$$\text{If } H_1 < \frac{2 B_d}{3 \sqrt{2}}, P_H = 1.5 H_1 \left(\gamma H - \frac{1.4CH}{B_d} - \pi C \right) \text{ in lbs/ linear foot}$$



— For trench excavations
 - - - For square pit or circle shaft

STABILITY OF BOTTOM
 FOR
 BRACED CUT

TABLE 1
GEOTECHNICAL DESIGN PARAMETER SUMMARY
OPEN-CUT EXCAVATION

Alignment	Boring Nos.	Stratigraphic Unit	Range of Depths, ft	Wet Unit Weight, γ , pcf	Submerged Unit Weight, γ' , pcf	Undrained Cohesion, C, psf	Internal Friction Angle, ϕ , degree
Proposed Duct Bank	B-1 and B-2	Cohesive	0-10	120	60	1,200	--

Notes:

1. Cohesive soils include lean clay with sand.



City of Houston Pay or Play Program Requirements



I. Pay or Play Program Overview

A. Purpose

The Pay or Play Program was established with Ordinance 2007-534 on July 1, 2007 and is governed by Executive Order 1-7. The Pay or Play Program (POP Program) creates a more level playing field and enhances fairness in the bid process between competing contractors that choose to offer health benefits to their workforce and those who do not. The program also recognizes and accounts for the fact that there are costs associated with health care of the uninsured citizens of the Houston and Harris County area.

B. Program Elements

1. Covered contracts:

- I.) Advertised after July 1, 2007 or which is executed on or after the effective date of this Executive Order.
- II.) Contracts valued at or above \$100,000.00 (contract) and \$200,000.00 (sub-contract) including contingencies, amendments, supplemental terms and/or change orders.
- III.) Professional Service, Construction, and Service type contracts.

2. Contracts not covered:

- I.) Any contract in which the primary purpose is procurement of property, goods, supplies, and or equipment.
- II.) An inter-governmental contract, inter-governmental agreement or purchasing cooperative.

3. Covered employees: This program applies to employees of a covered contractor or subcontractor, including contract labor, who are over age 18, work at least 30 hours per week and work any amount of time under a covered city contract or subcontract.

4. Pay or Play Option:

- I.) "Pays" by contributing \$1.00 per covered employee per regular hour for work performed under the contract with the City; or
- II.) "Plays" by providing health benefits to covered employees. Health benefits must meet or exceed the following standards:
 - The employer will contribute no less than \$150 per covered employee per month toward the total premium cost.
 - The employee contribution, if any amount, will be no greater than 50% of the monthly premium cost and no more than \$150 per month.

**Note: (1) A contractor is deemed to have complied with section 5.4 of E.O. 1-7 with respect to a covered employee who is not provided health benefits if the employee refuses the benefits and the employee's contribution to the premium is no more than \$40 per month. (2) If applicable the contractor has the option to both Pay and Play.*



City of Houston
Pay or Play Program Requirements



5. **Exemptions/Waivers:** The City of Houston will award a contract to a contractor that neither Pays nor Plays only if the contractor has received an approved waiver (Form POP-4 requested by City departments only).
6. **Administration:** Contractor performance in meeting Pay or Play program requirements will be managed by the contracting department. The Office of Business Opportunity (OBO) has administrative oversight of the program, including audit responsibilities (department compliance). Questions about the program should be referred to the Department POP Liaison an updated contact list is available on <http://www.houstontx.gov/obo/popforms.html> or call Gracie Orr with the Office of Business Opportunity at 832-393-0633.

II. Documentation and Reporting Requirements

A. Document that must be signed and returned to administering department with the bid/proposal.

- 1.) City of Houston Pay or Play Program Acknowledgment Form (Form POP-1) acknowledges bidder/proposers' knowledge of the program and its requirements, and the intention to comply.

B. Documents that must be signed and returned to administering department within a period designated by the department's Contract Administrator, upon notification of low bidder or successful proposer status:

- 1.) Certification of Compliance with Pay or Play Program (Form POP-2)

****Note - Contractors that opt to "play" must provide proof of coverage, including document from insurance provider, and names of covered employees.***

- 2.) List of Subcontractors (Form POP-3)

****Note- Review the affidavit statement at the bottom of this form for further important POP Compliance information.***

C. Contractors reporting requirements:

- 1.) Contractors that opt to Pay
Provide monthly reports to administering department, detailing names of employees, hours worked, exemptions (if any) and amount owed. (Form POP-5)
- 2.) Contractors that opt to Play
Provide periodic reports to the contract administrator showing proof of coverage (insurance premium invoice or insurance card) reporting schedule will be determined by administering department based on length of contract. (Form POP-7)



City of Houston Pay or Play Program Requirements



3.) Employee Waiver Request

Contractor may request POP program waiver by submitting the request on POP-8 if the employee is less than 18 years old, employee has other health coverage such as through spouse or parents, or Medicare/Medicaid.

****Note proof of coverage must be provided in the form of a copy of the employee's insurance card. (Remove social security numbers if applicable)***

- 4.) Contractors shall submit an initial report with the second invoice to the department. Payments based on monthly reports are due to the contracting department with submission of the following month's invoice. Payments may be made out to the City of Houston preferably via cashier check or business check.

III. Compliance and Enforcement

The Office of Business Opportunity will audit program compliance. Contractors willfully violating or misrepresenting POP program compliance will be subject to corrective and/or punitive action, including but not limited to the assessment of fines and penalties and/or debarment. The Pay or Play Program Requirements Form and all other POP Forms are available for downloading from the City of Houston's Website at <http://www.houstontx.gov/obo/popforms.html>

Section 01110

SUMMARY OF WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

Summary of the Work including contracted Scope of Work, work by the City, City-Furnished Products, Contracted Work Sequence, Contractor use of Premises, special conditions for substantial completion and City occupancy.

1.02 SCOPE OF WORK

- A. **A Bid Showing Site Visit is scheduled for Tuesday, March 10, 2015 at 1:30 pm. It will be conducted at the work site located at 2100 West 11th Street, Houston, Texas 77008.**
- B. The Work, under this Contract, consists of furnishing all labor, supervision, equipment, tools, materials, transportation, services, and related items necessary for the construction and completions, start-up and placing in service the Project described in the following paragraphs. The Work corresponds to Base Unit Price Items. Contractor shall provide testing of all systems to ensure performance in accordance with manufacturer's design and as specified herein; perform necessary adjustment as required, reporting proper functioning to OWNER; and all required equipment start-up services to place all systems in operation.
1. Mobilize labor, equipment, and facilities to set-up at the jobsite and provide and install the project identification sign.
 2. Demolition and salvaging in the chemical feed area - Demolish PVC piping, existing 6" high enclosure pad, emergency eyewash station, and 40 feet of on-grade water line. Salvage and store onsite two (2) in service ferrous sulfate and one (1) calcium nitrate chemical storage tanks, existing chemical feed pumps & FRP shelter. Store a third tank not in service onsite.
 3. Demolition and salvaging at the bio-scrubbers - Remove and dispose of 22'x14'x6.5' reinforced concrete equipment support box and stairs, buried foul air duct & concrete duct supports. Carefully drain, detach from existing construction and store onsite two (2) 10' tall x 11'-10" diameter biological tower-type wastewater odor control treatment vessels, irrigation systems, control systems, exposed ductwork, & two (2) foul air fans.
 4. Demolish and replace the existing chain link with privacy slat double gate at site access driveway with a new gate that matches the appearance of the existing gate.
 5. Odor control treatment system that includes two (2) biological tower-type odor treatment vessels, each with a capacity of 12,500 cfm, irrigation systems for biological activity, two (2) 25,000 cfm fans for moving the foul air to the vessels, instrumentation & controls, and buried and exposed foul air collection pipes and condensate collection pipes.
 6. Platform of aluminum structural shapes with aluminum grating 13'-10" X 11'-4" including aluminum handrail and aluminum stairway access and reinforced concrete pedestal for the odor control system control panel and the main power panel.
 7. Chemical feed equipment that includes two programmable peristaltic pumps with PVC pipe connections, manual valves and appurtenances for calcium nitrate feeding and two programmable peristaltic pumps with PVC pipe connections, manual valves, and appurtenances for ferrous sulfate feeding. Systems for each chemical to be mounted on a support framework suitable for wall mounting in the fiberglass shelter.
 8. Three (3) vertical, 4,000 gallon Cross-linked High-Density Polyethylene (HDPE) double wall bulk storage tanks with support stands and accessories, PVC piping and appurtenances connecting the tanks to the calcium nitrate and ferrous sulfate chemical feed pumps.

9. Prefabricated fiberglass shelter of 6' width by 4.5', and 7' wall height with insulated walls roof, door, and other appurtenances and walls suitable for mounting chemical feed equipment and panels. Open construction FRP support base 3' tall with solid platform surface for mounting the fiberglass shelter. Aluminum stair, handrail, and grated landing at shelter. Emergency eyewash/shower, hose station with manual shut-off valve in box, and two City standard concrete filled steel pipe bollards.
 10. Yard lighting, 3 new poles with LED lights, conduit, wiring, and terminations and relocate 1 existing light pole.
 11. Provide 200A/480V service including disconnect, meter, duct bank, conduits, and terminations from pole to odor control panel and duct bank, conduits, junction boxes, wiring and terminations, and instruments for the chemical feed system.
 12. Provide a grounding system for the bio-scrubber facilities.
 13. Provide a communication system, including 46' loan star concrete pole, WiMAX radio, PPU-1 pp, camera, wiring, LED light.
 14. Filter fabric barrier 300 feet long for storm water pollution control.
 15. Place 20 linear feet of hay bales for storm water pollution control.
 16. Ninety (90) feet of trench safety system for all types of soil, all depths over 5 feet.
 17. Extra ten (10) feet of trench safety system for all types of soil, all depths over 5 feet.
 18. Lime stabilize subgrade under fan pads and soil around existing odor control system slab.
 19. Saw cut and remove a 35' X 10' section of reinforced concrete paving at the chemical feed area of the site and replace with like pavement.
 20. Extra 5 square yards of concrete paving replacement.
 21. Install 190 feet of new buried ferrous sulfate and calcium nitrate feed pipes from the chemical containment area to an existing manhole and install a new buried water line through the area of removed pavement.
 22. Extra 30 feet of buried schedule 80 PVC pipe.
 23. Raise height of perimeter fence.
- C. The following shall be provided by the contractor as needed to complete the work specified. All work shall be coordinated with the OWNER'S project manager.
1. Temporary facilities and controls as specified in Division 1 Section 01504.
 2. Provide quality control, material testing, field-testing, and related services in accordance with Division 1 Section 01450. This work shall be coordinated with the OWNER'S contact person.
 3. Provide training of OWNER'S operation and maintenance personnel in accordance with Division 1 Section 01755. This work shall be coordinated with the OWNER'S Contact person,
 4. Field surveying required for support of construction operations.
- D. Extra Work Items
1. Unit Cost line items are provided in the Bid Form for common Extra Work Items associated with this project. All Extra Work shall be coordinated with the OWNER's project manager.
- E. Cash Allowances
1. Include the following specific Cash Allowances as indicated in the Bid Form:
 - a) Building Permit Allowance – This allowance to be used for reimbursement of actual Building Permit Fees.
 - b) General Architectural/Landscaping Allowance – This allowance to be used for landscaping required by the OWNER. Work shall not be done under this allowance unless approved by the OWNER's project manager.

1.03 CITY-FURNISHED PRODUCTS

- A. Items Furnished by the City for Installation and final connection by Contractor: Existing water meter at the site to be relocated.

- B. Contractor's Responsibilities:
 - 1. Handle, store, and Install, Products.
 - 2. Repair or replace items damaged in the construction.

1.04 WORK SEQUENCE

- A. Neighborhood sensitivity to odor emissions requires that the 11th St. Facility work in this contract be completed with limited down time of the existing odor control and chemical feed systems and the improved systems. Therefore, the contractor shall schedule and prioritize completion of the work in practical order and focus on coordinating equipment delivery and installation with demolition and salvage of the existing facilities to minimize odor facility and chemical feed facility down-time and construction delays. The contractor shall adhere to the following:
 - 1. The maximum length of time odorous air treatment by biological tower-type wastewater odor control treatment vessels can be suspended is 60 days. Contractor shall install and operate temporary biological tower type equipment with a minimum treatment capacity of 4,000 cfm, if necessary, to limit the suspension of odorous air treatment to 60 days.
 - 2. The maximum length of time operation of the chemical feed systems can be suspended is 60 days. Contractor shall provide temporary chemical feed systems if work on the contract has resulted in shut down of the chemical feed systems for the 60 day maximum.
- B. For other field work coordination requirements, the contractor is referred to Section 01312 - Coordination and Meetings.

1.05 CONTRACTOR USE OF PREMISES

- A. Comply with procedures for access to the site and Contractor's use of rights-of-way as specified in Section 01145 - Use of Premises.
- B. Construction Operations: Limited to the City's rights-of-way provided by the City and areas shown or described in the Contract documents.
- C. Utility Outages and Shutdown: Provide a minimum of 48 hours notice to the City and private utility companies (when applicable), excluding weekends and holidays, in advance of required utility shutdown. Coordinate all work as required.

1.06 STREET CUT ORDINANCE – not used

1.07 WARRANTY

Comply with warranty requirements in accordance with Document 00700 - General Conditions.

1.08 ADDITIONAL CONDITIONS FOR SUBSTANTIAL COMPLETION

- A. In addition to requirements outlined in Document 00700 – General Conditions, for Contractor to be substantially complete with the Work and call for inspection by Project Manager to confirm, the following conditions must be met or completed:
 - 1. Demonstrate the ability for the biological tower-type odor control system to meet the performance requirements.
 - 2. All testing shall be completed and accepted by Project Manager.

3. All SCADA and security equipment shall be installed, accepted by manufacturer's representative and approved for operation.
 4. Draft O&M manuals and training video for the equipment included in the manuals shall be delivered to Project Manager.
 5. Demonstrate the ability of the chemical feed system to operate under specified control regimes.
 6. Training shall be conducted, utilizing draft O&M manuals.
- B. No additional condition described in Paragraph 1.10 may be included in Contractor's punch list.

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 01145

USE OF PREMISES

1.01 SECTION INCLUDES

- A. General use of the site including properties inside and outside of rights-of-way, work affecting road, ramps, streets and driveways and notification to adjacent occupants.

1.02 RIGHTS-OF-WAY

- A. Confine access, and operations and storage areas to rights-of-way provided by the City as stipulated in Document 00700 - General Conditions; trespassing on abutting lands or other lands in the area is not allowed.
- B. Make arrangements, at no cost to the City, for temporary use of private properties. Contractor and Surety shall indemnify and hold harmless the City against claims or demands arising from such use of properties outside of rights-of-way. Submit a copy of agreements between private property owners and Contractor prior to use of the area. Agreements between private property owners and Contractor shall be notarized or bear the signatures of two witnesses.
- C. Obtain written permission from City of Houston Parks and Recreation Department for storage of materials on esplanades and other areas within rights-of-way under that department's jurisdiction. Submit copies of written permission prior to use of the area.
- D. Restrict total length of distributed materials along the route of construction to 1,000 linear feet unless otherwise approved in writing by City Engineer.

1.03 PROPERTIES OUTSIDE OF RIGHTS-OF-WAY

- A. Do not alter the condition of properties adjacent to and along rights-of-way.
- B. Do not use ways, means, methods, techniques, sequences, or procedures that result in damage to properties or improvements.
- C. Restore damaged properties outside of rights-of-ways at no cost to the city

1.04 USE OF SITE

- A. Obtain approvals from governing authorities prior to impeding or closing public roads and streets. Do not close more than two consecutive intersections at one time.

- B. Notify Project Manager and Public Works and Engineering Traffic Management Branch at least five working days prior to closing a street or street crossing. Obtain permits for street closures in advance.
- C. Maintain 10-foot-wide minimum access lanes for emergency vehicles including access to fire hydrants.
- D. Avoid obstructing drainage ditches or inlets. When obstruction is unavoidable due to requirements of the Work, provide grading and temporary drainage structures to maintain unimpeded flow.
- E. Locate and protect private lawn sprinkler systems that may exist within the site. Repair or replace damaged systems to condition existing at start of the Work, or better. Test irrigation system prior to construction.
- F. Conform to daily clean-up requirements of Article 3 of Document 00700 - General Conditions.
- G. Beware of overhead power lines existing in area and in close proximity of the Project. When 10 feet of clearance between energized overhead power line and construction-related activity cannot be maintained, request Center Point Energy (CPE) de-energize or move conflicting overhead power line. Contact CPE representatives at (713) 207-2222. Schedule, coordinate and pay costs associated with de-energizing or moving conflicting overhead power lines. When there is no separate pay item for this effort, include these costs in various items of bid that make such work necessary.

1.05 NOTIFICATION TO ADJACENT OCCUPANTS

- A. Notify individual occupants in areas to be effected by the Work of proposed construction and time schedule. Notify not less than 72 hours or more than two weeks prior to work performed within 200 feet of homes or businesses. Follow form and content of sample door hanger provided by Project Manager.
- B. Include in notification nature of the Work, and names and telephone numbers of two company representatives for resident contact available on 24-hour call.
- C. Submit proposed notification to Project Manager for approval. Consider ethnicity of the neighborhood where English is not the dominant language. Provide notice in an understandable language.

1.06 PUBLIC, TEMPORARY, AND CONSTRUCTION ROADS AND RAMPS

- A. Construct and maintain temporary detours, ramps, and roads to provide for normal public traffic flow when it is necessary to close public roads or streets.

- B. Provide mats or other means to prevent overloading or damage to existing roadways from tracked equipment, large tandem axle trucks or equipment that will damage the existing roadway surfaces.
- C. Construct and maintain access roads and parking areas as specified in Section 01504 - Temporary Facilities and Controls.

1.07 EXCAVATION IN STREETS AND DRIVEWAYS

- A. Avoid hindering or inconveniencing public travel on streets or intersecting alleys for more than two blocks at any one time, except by permission of City Engineer.
- B. Obtain Traffic Management Branch and City Engineer's approval when nature of the Work requires closure of an entire street. Permits required for street closure are Contractor's responsibility. Avoid unnecessary inconvenience to abutting property owners.
- C. Remove surplus materials and debris and open each block for public use, as work in that block is complete.
- D. Acceptance of any portion of the Work will not be based on return of street to public use.
- E. Avoid obstructing driveways or entrances to private property.
- F. Provide temporary crossings or complete excavation and backfill in one continuous operation to minimize duration of obstruction when excavation is required across drives or entrances.
- G. Provide barricades and signs in accordance with Section VI of the State of Texas Manual on Uniform Traffic Control Devices.

1.08 TRAFFIC CONTROL

- A. Comply with traffic regulation as specified in Section 01555 - Traffic Control and Regulation.

1.09 SURFACE RESTORATION

- A. Restore the site including landscaping to the condition existing before construction, or better.
- B. Repair paved areas per the requirements of Section 02951 - Pavement Repair and restoration.

USE OF PREMISES**STANDARD GENERAL REQUIREMENT**

- C. Repair damaged turf areas, level with bank run sand conforming to Section 02317 - Excavation and Backfill for Utilities, or topsoil conforming to Section 02911 - Topsoil, and re-sod in accordance with Section 02922 - Sodding. Water and level newly sodded areas with adjoining turf using appropriate steel wheel rollers for sodding. Do not use spot sodding or sprigging.

1.10 LIMITS OF CONSTRUCTION

- A. Confine operations to lands within construction work limits shown on Drawings. Unless otherwise noted on Drawings adhere to the following:
1. Where utility alignment is within esplanade, and construction limits are shown on Drawings to extend to edge of esplanade, keep equipment, materials, stockpiles a minimum of five feet from back of curb.
 2. Where construction limits shown on Drawings extend to property line, keep sidewalks free of equipment, materials, and stockpiles.

1.11 EQUIPMENT AND MATERIAL SALVAGE

- A. Upon completion of the Work, carefully remove salvageable equipment and material. Deliver them to City of Houston as directed by Project Manager. Dispose of equipment offsite at no additional cost to the City when Project Manager deems equipment unfit for further use.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

Section 01255

CHANGE ORDER PROCEDURES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Procedures for processing Change Orders, including:
 - 1. Assignment of a responsible individual for approval and communication of changes in the Work;
 - 2. Documentation of change in Contract Price and Contract Time;
 - 3. Change procedures, using proposals and Modifications;
 - 4. Execution of Change Orders;
 - 5. Correlation of Contractor submittals.

1.02 REFERENCES

- A. Blue Book is defined as the Rental Rate Blue Book for Construction Equipment (a.k.a. Data Quest Blue Book).
- B. Rental Rate is defined as the full-unadjusted base rental rate for the appropriate item of construction equipment.

1.03 RESPONSIBLE INDIVIDUAL

- A. Provide a letter indicating the name and address of the individual authorized to execute Modifications, and who will be responsible for informing others in Contractor's employ and Subcontractors of changes to the Work. Provide this information at the pre-construction meeting.

1.04 DOCUMENTATION OF CHANGE IN CONTRACT PRICE AND CONTRACT TIME

- A. Maintain detailed records of changes in the Work. Provide full information required for identification and evaluation of proposed changes, and substantiate costs of changes in the Work.
- B. Document each proposal for change in Contract Price or Contract Time with sufficient data to allow evaluation of proposal.

- C. Include the following minimum information on proposals:
1. Quantities of items in original Document 00410 – Bid Form with additions, reductions, deletions, and substitutions.
 2. Quantities and cost of items in original Schedule of Values with additions, reductions, deletions and substitutions.
 3. Provide Unit Prices for new items, with supporting information, for inclusion in Schedule of Unit Price Work.
 4. Justification for changes in Contract Time.
 5. Additional data upon request.
- D. For changes in the Work performed on a time-and-material basis, provide the following additional information:
1. Quantities and description of Products.
 2. Taxes, insurance and Bonds.
 3. Overhead and profit as noted in Document 00700 - General Conditions.
 4. Dates, times and by who work was performed.
 5. Time records and certified copies of applicable payrolls.
 6. Invoices and receipts for Products, rental equipment, and subcontracts, similarly documented.
- E. For changes in the Work performed on a time-and-materials basis, rental equipment is paid as follows:
1. Actual invoice cost for duration of time required to complete extra work without markup for overhead and profit. When extra work comprises only a portion of a rental invoice where equipment would otherwise be on site, compute hourly equipment rate by dividing the actual monthly invoice by 176. One day equals eight hours and one week equals 40 hours.
 2. Do not exceed estimated operating costs given in Blue Book for items of equipment. Overhead and profit will be allowed on the operating cost.

- F. For changes in the Work performed on a time-and-materials basis using Contractor-owned equipment, use Blue Book rates as follows:
1. Contractor-owned equipment will be paid at the Blue Book Rental Rate for the duration of time required to complete extra work without markup for overhead and profit. Utilize lowest cost combination of hourly, daily, weekly or monthly rates. Use 150 percent of Rental Rate for double shifts, one extra shift per day, and 200 percent of Rental Rate for more than two shifts per day. Standby rates shall be 50 percent of the appropriate Rental Rate shown in Blue Book. No other rate adjustments apply.
 2. Do not exceed estimated operating costs given in Blue Book. Overhead and profit will be allowed on operating costs. Operating costs will not be allowed for equipment on standby.

1.05 CHANGE PROCEDURES

- A. Changes to Contract Price or Contract Time can only be made by issuance of Document 00941 - Change Order. Issuance of Document 00940 - Work Change Directive will be formalized into a Change Order. Changes will be in accordance with requirements of Document 00700 - General Conditions.
- B. City Engineer will advise of Minor Changes in the Work as authorized by the Document 00700 - General Conditions by issuing Document 00942 – Minor Change.
- C. Request clarification of Drawings, Specifications, Contract documents or other information by using Document 00931- Request for Information. Response by Project Manager to Requests for Information does not authorize Contractor to perform tasks outside scope of the Work. Changes must be authorized as described in this Section.

1.06 PROPOSALS AND CONTRACT MODIFICATIONS

- A. Project Manager may issue Document 00932- Request for Proposal, which includes a detailed description of the proposed change with supplementary or revised Drawings and Specifications. Project Manager may also request a proposal in response to a Request for Information. Prepare and submit the proposal within seven days or as specified in request.
- B. Submit requests for Contract changes to City Engineer describing proposed change and its full effect on the Work, with a statement describing reason for change and effect on Contract Price and Contract Time including full documentation.

- C. Design Consultant may review Change Orders.

1.07 WORK CHANGE DIRECTIVE

- A. City Engineer may issue a signed Work Change Directive instructing Contractor to proceed with a change in the Work. Work Change Directive will subsequently be incorporated into a Change Order.
- B. Work Change Directives will describe changes in the Work and designate the method of determining change in Contract Price or Contract Time.
- C. Proceed promptly to execute changes in the Work in accordance with the Work Change Directive.

1.08 STIPULATED PRICE CHANGE ORDER

- A. A Stipulated Price Change Order will be based on an accepted proposal.

1.09 UNIT PRICE CHANGE ORDER

- A. Where Unit Prices for affected items of the Work are included in Document 00410 – Bid Form, the Change Order will be based on Unit Prices, subject to Articles 7 and 9 of Document 00700 - General Conditions.
- B. Where Unit Prices of the Work are not pre-determined in Document 00410-Bid Form, the Work Change Directive or accepted proposal will specify the Unit Prices to be used.

1.10 TIME-AND-MATERIAL CHANGE ORDER

- A. Provide itemized account and supporting data after completion of change, within time limits indicated for claims in Document 00700 - General Conditions.
- B. City Engineer will determine the change allowable in Contract Price and Contract Time as provided in Document 00700 - General Conditions.
- C. Maintain detailed records for work done on time-and-material basis as specified in Paragraph 1.04 above.
- D. Provide full information required for evaluation of changes and substantiate costs for changes in the Work.

1.11 EXECUTION OF CHANGE DOCUMENTATION

- A. City Engineer will issue Change Orders, Work Change Directives, or Minor Change in the Work for signatures of Parties as described in Document 00700 - General Conditions.

1.12 CORRELATION OF CONTRACTOR SUBMITTALS

- A. For Stipulated Price Contracts, promptly revise Schedule of Values and Application for Payment forms to record authorized Change Orders as separate line item.
- B. For Unit Price Contracts, the next monthly estimate of the Work after acceptance of a Change Order will be revised to include new items not previously included with appropriate Unit Prices.
- C. Promptly revise progress schedules to reflect change in Contract Time, and to adjust time for other items of work affected by the change, and resubmit for review.
- D. Promptly enter changes to on-site and record copies of Drawings, Specifications or Contract documents as required in Section 01785 - Project Record Documents.

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 01270

MEASUREMENT AND PAYMENT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Procedures for measurement and payment plus conditions for nonconformance assessment and nonpayment for rejected Products.

1.02 AUTHORITY

- A. Measurement methods delineated in Specification sections are intended to complement criteria of this Section. In event of conflict, requirements of the Specification section shall govern.
- B. Project Manager will take all measurements and compute quantities accordingly.
- C. Assist by providing necessary equipment, workers, and survey personnel.
- D. Measurement and Payment paragraphs are included only in those Specification sections of Division 01 where direct payment will be made. Include costs in the total bid price for those Specification sections in Division 01 that do not contain Measurement and Payment paragraphs,

1.03 UNIT QUANTITIES SPECIFIED

- A. Quantity and measurement estimates stated in the Agreement are for contract purposes only. Quantities and measurements supplied or placed in the Work and verified by Project Manager will determine payment as stated in Article 9 of Document 00700 - General Conditions.
- B. When actual work requires greater or lesser quantities than those quantities indicated in Document 00410 – Bid Form, provide required quantities at Unit Prices contracted, except as otherwise stated in Article 9 of Document 00700 - General Conditions.

1.04 MEASUREMENT OF QUANTITIES

- A. Measurement by Weight: Reinforcing steel, rolled or formed steel or other metal shapes are measured by CRSI or AISC Manual of Steel Construction weights. Welded assemblies are measured by CRSI or AISC Manual of Steel Construction or scale weights.

MEASUREMENT AND PAYMENT**STANDARD GENERAL REQUIREMENT**

- B. Measurement by Volume:
 - 1. Stockpiles: Measured by cubic dimension using mean length, width, and height or thickness.
 - 2. Excavation and Embankment Materials: Measured by cubic dimension using average end area method.
- C. Measurement by Area: Measured by square dimension using mean length and width or radius.
- D. Linear Measurement: Measured by linear dimension, at item centerline or mean chord.
- E. Stipulated Price Measurement: By unit designated in the Agreement.
- F. Other: Items measured by weight, volume, area, or linear means or combination, as appropriate, as completed item or unit of the Work.
- G. Measurement by Each: Measured by each instance or item provided.
- H. Measurement by Lump Sum: Measure includes all associated work.

1.05 PAYMENT

- A. Payment includes full compensation for all required supervision, labor, Products, tools, equipment, plant, transportation, services, and incidentals; and erection, application or Installation of an item of the Work; and Contractor's overhead and profit.
- B. Total compensation for required Unit Price work shall be included in Unit Price bid in Document 00410 – Bid Form. Claims for payment as Unit Price work, but not specifically covered in the list of Unit Prices contained in Document 00410 – Bid Form, will not be accepted.
- C. Interim payments for stored materials will be made only for materials to be incorporated under items covered in Unit Prices, unless disallowed in Document 00800 - Supplementary Conditions.
- D. Progress payments will be based on Project Manager's observations and evaluations of quantities incorporated in the Work multiplied by Unit Price.
- E. Final payment for work governed by Unit Prices will be made on the basis of actual measurements and quantities determined by Project Manager multiplied by the Unit Price for work which is incorporated in or made necessary by the Work.

1.06 NONCONFORMANCE ASSESSMENT

- A. Remove and replace work, or portions of the Work, not conforming to the Contract documents.
- B. When not practical to remove and replace work, City Engineer will direct one of the following remedies:
 - 1. Nonconforming work will remain as is, but Unit Price will be adjusted lower at discretion of City Engineer.
 - 2. Nonconforming work will be modified as authorized by City Engineer, and the Unit Price will be adjusted lower at the discretion of City Engineer, when modified work is deemed less suitable than specified.
- C. Specification sections may modify the above remedies or may identify a specific formula or percentage price reduction.
- D. Authority of City Engineer to assess nonconforming work and identify payment adjustment is final.

1.07 NONPAYMENT FOR REJECTED PRODUCTS

- A. Payment will not be made for any of the following:
 - 1. Products wasted or disposed of in an unacceptable manner.
 - 2. Products determined as nonconforming before or after placement.
 - 3. Products not completely unloaded from transporting vehicles.
 - 4. Products placed beyond lines and levels of required work.
 - 5. Products remaining on hand after completion of the Work, unless specified otherwise.
 - 6. Loading, hauling, and disposing of rejected Products.

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 01292

SCHEDULE OF VALUES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Preparation and submittal of Schedule of Values for Stipulated Price Contracts or for Major Unit Price Work on Unit Price Contracts.

1.02 PREPARATION

- A. For Stipulated Price Contracts, subdivide the Schedule of Values into logical portions of the Work, such as major work items or work in contiguous construction areas. Use Section 01325 - Construction Schedule as a guide to subdivision of work items. Directly correlate Items in the Schedule of Values with tasks in the Construction Schedule. Organize each portion using the Project Manual Table of Contents as an outline for listing value of the Work by Sections. A pro rata share of mobilization, Bonds, and insurance may be listed as separate items for each portion of the Work.
- B. For Unit Price Contracts, items should include a proportional share of Contractor's overhead and profit so that total of all items will equal Contract Price.
- C. For lump sum equipment items, where submittal of operation and maintenance data and testing are required, include separate items for equipment operation and maintenance data where:
 - 1. submittal of maintenance data is valued at five percent of the lump sum amount for each equipment item and
 - 2. submittal for testing and adjusting is valued at five percent of the lump sum amount for each equipment item.

Round off figures for each item listed to the nearest \$100. Set the value of one item, when necessary, to make total of all values equal the Contract Price for Stipulated Price Contracts or the lump sum amount for Unit Price Work.

SCHEDULE OF VALUES

CITY OF HOUSTON
STANDARD GENERAL REQUIREMENT

1.03 SUBMITTAL

- A. Submit the Schedule of Values, in accordance with requirements of Section 01330 - Submittal Procedures, at least 10 days prior to processing of the first Certificate for Payment.
- B. Submit the Schedule of Values in an approved electronic spreadsheet file and an 8 1/2-inch by 11-inch print on white bond paper.
- C. Revise Schedule of Values for items affected by Contract Modifications. After City Engineer has reviewed changes, resubmit at least 10 days prior to the next scheduled Certificate for Payment date.

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 01312

COORDINATION AND MEETINGS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. General coordination including pre-construction meeting, site mobilization conference, and progress meetings.

1.02 COORDINATION OF DOCUMENTS

- A. Coordination is required throughout documents. Refer to Contract documents and coordinate as necessary.

1.03 CONTRACTOR COORDINATION

- A. Coordinate scheduling, submittals, and work of various Specification sections to assure efficient and orderly sequence of Installation of interdependent construction elements.
- B. Coordinate completion and clean up of the Work prior to the Date of Substantial Completion and for portions of the Work designated for City's partial occupancy.
- C. Coordinate access to the site for correction of nonconforming work to minimize disruption of the City's activities where the City is in partial occupancy.

1.04 PRE-CONSTRUCTION MEETING

- A. Project Manager will schedule pre-construction meeting.
- B. Attendance Required: City representatives, Design Consultant, special consultants as required by Project Manager, Contractor, and major Subcontractors and Suppliers.
- C. Agenda:
 - 1. Distribution of Contract documents.
 - 2. Designation of personnel representing the Parties and Design Consultant.

3. Review of insurance.
4. Discussion of formats for Schedule of Values and Construction Schedule.
5. Procedures and processing of Shop Drawings, substitutions, pay estimates or Applications for Payment, Requests for Information, Requests for Proposal, Modifications, and the Contract closeout, other submittals.
6. Scheduling of the Work and coordination with other contractors.
7. Review of Subcontractors and Suppliers.
8. Appropriate agenda items listed for the site mobilization conference, Paragraph 1.05.C, when pre-construction meeting and site mobilization conference are combined.
9. Procedures for testing.
10. Procedures for maintaining record documents.

1.05 SITE MOBILIZATION CONFERENCE

- A. When required by Contract documents, Project Manager will schedule a conference at the Project site prior to Contractor mobilization.
- B. Attendance Required: City representatives, Design Consultant, special consultants, Superintendent, and major Subcontractors.
- C. Agenda:
 1. Use of premises by the City and Contractor.
 2. Safety and first aid procedures.
 3. Construction controls provided by the City.
 4. Temporary utilities.
 5. Survey and layout.
 6. Security and housekeeping procedures.
 7. Field office requirements.

1.06 PROGRESS MEETINGS

- A. Hold meetings at Project field office or other location designated by Project Manager. Hold meetings at monthly intervals, or more frequently when directed by Project Manager.
- B. Attendance Required: Superintendent, major Subcontractors and Suppliers, City representatives, Design Consultant and its subconsultants as appropriate for agenda topics for each meeting.
- C. Project Manager will make arrangements for meetings, and for recording minutes.
- D. Project Manager will prepare the agenda and preside at meetings.
- E. Provide required information and be prepared to discuss each agenda item.
- F. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of construction schedule, pay estimates, cash flow curve, payroll and compliance submittals.
 - 3. Field observations, problems, and necessary decisions.
 - 4. Identification of problems that impede planned progress.
 - 5. Review of submittal schedule and status of submittals.
 - 6. Review of RFI and RFP status.
 - 7. Modification status.
 - 8. Review of off-site fabrication and delivery schedules.
 - 9. Maintenance of Construction Schedule.
 - 10. Corrective measures to regain Construction Schedule.
 - 11. Planned progress during the succeeding work period.
 - 12. Coordination of projected progress.
 - 13. Maintenance of quality and work standards.

COORDINATION AND MEETINGS

CITY OF HOUSTON
STANDARD GENERAL REQUIREMENT

14. Effect of proposed Modifications on Construction Schedule and coordination.

15. Review Project Record Contract Drawings.

16. Other item relating to the Work.

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 01321

CONSTRUCTION PHOTOGRAPHS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Photographic requirements for construction photographs and submittals.

1.02 DEFINITIONS

- A. Pre-construction Photographs: Photographs taken, in sufficient numbers and detail, prior to Date of Commencement of the Work, to show original construction site conditions.
- B. Progress Photographs: Photographs, taken throughout the duration of construction at regular intervals and from fixed vantage points, pre-approved by the City, that document progress of the Work.
- C. Finished Photographs: Photographs, taken by a professional photographer near Date of Substantial Completion and before City Council's acceptance of the Work, that are suitable for framing and for use in brochures or on the Internet

1.03 SUBMITTALS

- A. Refer to Section 01330, Submittal Procedures, for submittal requirements.
- B. Format and Media. Film or digital photography may be used. Submit color photographs, unless otherwise specified.
 - 1. Prints. Submit each Progress or Pre-construction Photograph print in a three-hole plastic pocket or sleeve, bound in a three-ring notebook. Produce prints on photographic-quality paper approved by Project Manager. Minimum size for Pre-construction Photograph prints shall be 3-inches by 5-inches. Progress Photograph prints shall be 8-inches by 10-inches.
 - 2. Film. Use 35mm or larger color film. Submit negatives used to make submitted photographs, in 3-hole 8-1/2 inch by 11-inch plastic sheets with sleeves for negatives.
 - 3. Digital Photography. Use 2.1 megapixel density or greater for photographs. Scanned photographs must equal or exceed 400 dots

per inch when scanned from 8-inch by 10-inch prints. Submit digital photographic files on computer disks. Format disks for MS-DOS (Microsoft Disk Operating System) filing system and in JPEG (Joint Photographic Experts Group) format.

C. Submittal Quantities and Frequencies.

1. Pre-construction Photographs:
 - a. For Stipulated Price Contracts, submit two sets of Pre-construction Photographs, if required, prior to first Application for Payment.
 - b. For Unit Price Contracts, submit two sets of Pre-construction Photographs prior to start of construction operations.
2. Progress Photographs:
 - a. For Stipulated Price Contracts, submit three sets of Progress Photographs with each Application for Payment at the times established for submittal of Applications for Payment. Monthly Applications for Payment shall be deemed incomplete if not accompanied by the required Progress Photographs. Contractor's failure or election to not submit a monthly Application for Payment shall not affect the requirement for monthly Progress Photographs.
 - b. Progress Photographs are not required for Unit Price Contracts unless otherwise specified.
3. Finished Photographs: For Stipulated Price Contracts submit two sets of Finished Photographs, if required, after Date of Substantial Completion and prior to final payment. Each set shall contain one 11-inch by 14-inch matte finish color photographic print from each of the two vantage points pre-approved by the City. Vantage points for Finished Photographs will be approved separately from vantage points approved for Progress Photographs. Finished Photographs are not required for Unit Price Contracts unless otherwise specified.

D. Labeling. Place a label on the back of each photographic print, applied so as to not to show through on the front. Labels shall contain the following information:

1. Name of Project, address of Project and GFS Number.
2. Name and address of Contractor.
3. Date photograph was taken.
4. Location photo was taken from and short description of photo subject.

5. Name and address of professional photographer who took the photograph, if applicable.

E. Hand-deliver or transmit prints in standard photographic mailers marked "Photographs - Do Not Bend".

F. Photographic prints, negatives, photographic files and disks become the property of the City. Do not be publish photographs without written consent by the City.

1.04 QUALITY ASSURANCE

A. Contractor shall be responsible for the quality of and timely execution and submittal of photographs.

B. For Finished Photographs, Contractor shall use a professional photographer, with five years minimum professional experience in the Houston area. Contractor shall submit name, address and credentials of professional photographer for Project Manager's review and approval.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 PRE-CONSTRUCTION PHOTOGRAPHS

A. Prior to commencement of construction operations, photograph the site to include initial construction corridor, detour routes, and staging or storage areas.

1. For Stipulated Price Contracts, unless specified as a requirement in other Sections, these photographs are optional for Contractor, but are highly recommended for areas bounded by other property owners.

2. Pre-construction photographs are required for Unit Price Contracts. For line projects with scheduled construction segments, take Pre-construction Photographs prior to commencement of work on each segment.

- B. Prepare Pre-construction Photographs as follows:
1. Show the following information on a non-reflective chalkboard placed within the picture frame:
 - a. Job number.
 - b. Project Number.
 - c. Date and time photographs were taken (Automatic date/time in negative is acceptable).
 - d. Baseline station, direction of view (i.e. N, S, NW, etc.) and house number or street address and street name.
 2. Pre-construction Photographs shall indicate condition of the following:
 - a. Esplanades and boulevards.
 - b. Yards (near side and far side of street).
 - c. House walks and sidewalks.
 - d. Curbs.
 - e. Areas between walks and curbs.
 - f. Particular features (e.g. yard lights, shrubs, fences, trees).
 3. Show date photographs were taken on negatives.
- C. Show the location of vantage points and direction of shots on a key plan of the site.

3.02 PROGRESS PHOTOGRAPHS

- A. Progress Photographs document monthly advancement of the Work. Select vantage points for each shot so as to best show status of construction and progress since last photograph submittal. Select camera stations that will require little or no movement or adjustment over the duration of construction.
- B. Take monthly Progress Photographs at regular intervals to coincide with cutoff dates associated with each Application for Payment.

3.03 FINISHED PHOTOGRAPHS

- A. Finished Photographs shall be "staged" and taken by a professional photographer to depict the most flattering images of a finished facility. Two vantage points, from which Finished Photographs will be taken, shall be agreed to in advance by the City. Photographer shall consider lighting, time of day, height of eye, landscaping and placement of vehicles, people and other props in each picture. Filters and post-photography processing may be utilized to achieve a finished product acceptable to the City.

3.04 LOCATION

- A. Vantage points, times and conditions for camera stations and photography for Progress and Finished Photographs shall be mutually agreed upon by the City, Contractor and Photographer. Progress Photograph vantage points may be changed by mutual agreement as the Work progresses, at no additional cost to the City.

END OF SECTION

Section 01325

CONSTRUCTION SCHEDULE

PART 1 G E N E R A L

1.01 GENERAL

- A. Provide Construction Schedules for the Work included in this Contract in accordance with requirements in this Section. Create Construction Schedule using Critical Path Method (CPM) computer software capable of mathematical analysis of Precedence Diagramming Method (PDM) plan. Provide printed activity listings and bar charts in formats described in this Section.
- B. Combine activity listings and bar charts with narrative report to form Construction Schedule submittal for Project Manager.

1.02 SCHEDULING STAFF

- A. Employ or retain services of individual experienced in CPM scheduling for duration of the Contract. Individual shall cooperate with Project Manager and update schedule monthly as required to indicate current status of the Work.

1.03 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. During preconstruction meeting, as described in Section 01312 - Coordination and Meetings, provide sample bar charts and activity listings produced from scheduling software proposed. Scheduling software is subject to review by Project Manager and must meet requirements provided in this Section. Project Manager will provide review of samples within seven days of submittal.
- C. Within 21 days of receipt of approval of Contractor's format, or 30 days of Notice to Proceed, whichever is later, submit proposed Construction Schedule for review. Base Construction Schedule submittal on the following:
 - 1. Level of detail and number of activities required in schedule are dependent on project type.
 - a. For wastewater projects, categorize work type and area code in schedule.
 - 1) For wastewater rehabilitation projects, there are six work-type categories. An area code will be assigned for each

Meter Service Area or Basin. Include at least one activity for each unique combination of work type and area code.

Normal schedules of wastewater rehabilitation projects contain between 35 and 100 activities, depending on number of basins and work types involved in each basin.

- 2) For wastewater relief projects (line work), area codes will be assigned geographically.
 - 3) For wastewater plant or facility work, other criteria may apply to assignment of area codes, such as a combination of geographical and craft categories.
 - b. For projects with multiple types of tasks within scope, indicate types of work separately within schedule.
 - c. For projects with work at different physical locations or service areas, or different facilities within a site, indicate each location or facility separately within schedule. Show work on each floor of multi-story building as separate tasks.
 - d. For projects with multiple crafts or significant Subcontractor components, indicate elements separately within schedule. Unless permitted by Project Manager, tasks shall consist of work covered by only one division of Project Manual.
2. Unless permitted by Project Manager, each scheduled task shall be same as Schedule of Values line item, and vice versa.
 3. For projects with Major Unit Price Work, indicate Shop Drawing submittal and review, purchase, delivery, and Installation dates on Project schedule. Include activities for testing, adjustment, and delivering O&M manuals.
 4. No task except the acquisition of Major Unit Price Work shall represent more than one percent of Original Contract Price for facility projects and three percent of Original Contract Price for other projects. Duration of tasks may not exceed 40 calendar days.
 5. For projects where operating facilities are involved, identify each period of work that will impact any process or operation in the schedule and that must be agreed to by Project Manager and facility operator prior to starting work in the area.
- D. Construction Schedule submittals shall include:
1. printed bar charts that meet criteria outlined in this Section and are produced by Contractor's approved scheduling software;
 2. activity listings that meet criteria outlined in this Section and are produced by Contractor's approved scheduling software; and

3. a predecessor/successor listing sorted by Activity ID that meets criteria outlined in this Section and is produced by Contractor's scheduling software.
 4. A logic network diagram is required with the first Construction Schedule submittal for facilities projects.
 5. Prepare and submit graphic or tabular display of estimated monthly billings (i.e. a cash flow curve for the Work) with the first schedule submittal. This information is not required in monthly updates, unless significant changes in work require re-submittal of schedule for review. Display shall allocate units indicated in bid schedule or Schedule of Values to Construction Schedule activities. Weighted allocations are acceptable, where appropriate. Dollar value associated with each allocated unit will be spread across the duration of that activity on a monthly basis. Total for each month and cumulative total will be indicated. These monthly forecasts are only for Project Manager's planning purposes. Monthly payments for actual work completed will be made in accordance with Document 00700 - General Conditions.
 6. Narrative Report that provides the information outlined in this Section.
- E. No payment will be made until Project Manager approves Construction Schedule and billing forecast.
 - F. If Contractor desires to make changes in its method of operating and scheduling, after Project Manager has reviewed original schedule, notify Project Manager in writing, stating reasons for changes. When Project Manager considers these changes to be significant, Contractor may be required to revise and resubmit for review all or affected portion of Contractor's Construction Schedule to show effect on the Work.
 - G. Upon written request from Project Manager, revise and submit for review all or any part of Construction Schedule submittal to reflect changed conditions in the Work or deviations made from original schedule.
 - H. Updated Construction Schedule with actual start and actual finish dates, percent complete, and remaining duration of each activity shall be submitted monthly. Data date used in updating monthly Construction Schedule shall be the same date as used in monthly Payment Application. Monthly update of Construction Schedule is required for monthly Payment Application to be processed for payment.

1.04 SCHEDULING COMPUTER SOFTWARE REQUIREMENTS

- A. Contractor's scheduling software shall be capable of creating bar charts and activity listings, which can be sorted by various fields (i.e. Activity ID, Early Start, Total Float, Area Code, Specification Section number, and Subcontractor). Use software capable of producing logic network diagram.
- B. Use scheduling software capable of producing activity listings and bar charts with the following information for each activity in the schedule:
 - 1. Activity ID
 - 2. Activity Description
 - 3. Estimated (Original) Duration
 - 4. Remaining Duration
 - 5. Actual Duration
 - 6. Early Start Date
 - 7. Late Start Date
 - 8. Early Finish Date
 - 9. Late Finish Date
 - 10. Free Float
 - 11. Total Float
 - 12. Activity Codes (such as Area Code, Work Type, Specification Section, Subcontractor)
- C. Use scheduling software capable of printing calendars using mathematical analysis of schedule, indicating standard workdays of week and scheduled holidays.
- D. Use scheduling software capable of printing activity listing that indicates predecessors and successors, lag factors and lag relationships used in creating logic of the schedule.
- E. Use scheduling software to provide monthly time in Bar Chart format and scale with 12-month scale not to exceed one page width. Bar charts may be

printed or plotted on 8-1/2 by 11-inch, 8-1/2 by 14-inch or 11 by 17-inch sheet sizes. Over-size plots are not acceptable.

1.05 NARRATIVE SCHEDULE REPORT

- A. Narrative schedule report shall list activities started this month, activities completed this month, activities continued this month, activities scheduled to start or complete next month, problems encountered this month, and actions taken to solve these problems.
- B. Narrative schedule report shall describe changes made to Construction Schedule logic (i.e. changes in predecessors and lags), activities added to schedule, activities deleted from schedule, any other changes made to the schedule other than addition of actual start dates and actual finish dates and changes of data date and remaining durations for re-calculation of mathematical analysis.

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 01326

CONSTRUCTION SCHEDULE (BAR CHART)

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Provide an initial Construction Schedule as required by this section for the Work. Do not start construction until Project Manager reviews the schedule.

1.02 FORM AND CONTENT OF INITIAL CONSTRUCTION SCHEDULE

A. Bar Chart:

1. Show major construction activities such as pipe laying, by traffic control phases or other approved key areas; tunnel construction, pavement removal, pavement replacement, pressure testing, chlorination, clean up and punch list as separate activities on the schedule.
2. Show week duration for each activity.
3. Show separate activities for each Shop Drawing and Product Data submittal critical to timely completion. Show submittal dates and dates Project Manager needs to provide approved submittals.
4. Provide separate horizontal bar for each activity. List start and finish date for each activity at left side of diagram.
5. Horizontal Time Scale: Identify first work day of each week.
6. Scale and Spacing: Notes must be legible. Allow space for notations and future revisions.
7. Order of Listings: Order bar chart listings by phases or other approved groups of activities that are contiguous. List activities in chronological order within each phase or group.

B. Narrative Description:

1. Submit narrative descriptions of anticipated work sequences as indicated by the sequence of activities presented in the schedule.

2. Discuss any activity that affects the public (such as phases of traffic control), interaction with specific forces of the City (such as valve operation, chlorination and testing) or other associated contractors.

1.03 PROGRESS REVISIONS

- A. Submit progress revisions or necessary information to complete and process Payment Applications. When required, re-submittals for rejected revisions must be submitted and reviewed prior to the following month's processing of a Payment Application. The following month's Payment Application will not be processed until the re-submittal is reviewed and required progress revisions are received.
- B. Provide a narrative report to describe:
 1. Major changes in scope.
 2. Revised projections in progress, completion, or changes in activity duration.
 3. Other identifiable changes.
 4. Problem areas, anticipated delays, and the impact on schedule.
 5. Corrective action recommended and its effect.
 6. Effect of changes on schedules or other contractors.
 7. Product delivery lead times.
- C. Include additional data with Bar Chart described in Paragraph 1.03A of this Section:
 1. Show original dates for each activity in the approved initial progress schedule by narrow bar next to a wider bar for the current schedule.
 2. Show date each activity actually started or finished when an event has occurred. Clearly identify actual dates in two right-most columns in left portion of an 11 by 17-inch chart.
 3. Indicate the percentage progress to the date of submittal for each activity.

1.04 SUBMITTALS

- A. Submit the initial progress schedule within 15 days after award of contract. Project Manager will review the schedule and return a reviewed copy within 21 days after receipt.
- B. Cut-off dates for progress revisions may be as early as the 20th of the month to avoid delaying processing of Payment Applications. Use the cut-off date for the first approved revision for further revisions.
- C. When required, re-submit within seven days after return of review copy.
- D. Include connecting lines between bars in the schedule to indicate the sequence that activities will be accomplished. Connecting lines when the activity's start or finish is modified will identify impact of preceding or succeeding activities. Submit a minimum of six copies of the bar chart on 11 by 17-inch opaque reproductions. Project Manager will retain five copies and return the remaining copy.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

Section 01330

SUBMITTAL PROCEDURES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Submittal procedures for:

1. Schedule of Values
2. Construction Schedules and Cash Flow Curve (billing forecast).
3. Shop Drawings, Product Data and Samples
4. Operations and Maintenance (O&M) Data
5. Manufacturer's Certificates
6. Construction Photographs
7. Project Record Documents and monthly certification.
8. Video Tapes
9. Design Mixes

1.02 SUBMITTAL PROCEDURES

A. Scheduling and Handling:

1. Submit Shop Drawings, data and Samples for related components as required by Specifications and Project Manager.
2. Schedule submittals well in advance of need for construction Products. Allow time for delivery of Products after submittal approval.
3. Develop submittal schedule that allows sufficient time for initial review, correction, resubmission and final review of all submittals. Allow a minimum of 30 days for initial review. Project Manager will review and return submittals to Contractor as expeditiously as possible but time required for review will vary depending on complexity and quantity of data submitted.

4. Project Manager's review of submittals covers only general conformity to Drawings, Specifications and dimensions that affect layout. Contractor is responsible for quantity determination. No quantities will be verified by Project Manager. Contractor is responsible for errors, omissions or deviations from Contract requirements; review of submittals does not relieve Contractor from the obligation to furnish required items in accordance with Drawings and Specifications.
5. Submit five copies of documents unless otherwise specified.
6. Revise and resubmit submittals as required. Identify all changes made since previous submittal.
7. Assume risk for fabricated Products delivered prior to approval. Do not incorporate Products into the Work, or include payment for Products in periodic progress payments, until approved by Project Manager.

B. Transmittal Form and Numbering:

1. Transmit each submittal to Project Manager with Transmittal letter which includes:
 - a. Date and submittal number
 - b. Project title and number
 - c. Names of Contractor, Subcontractor, Supplier and manufacturer
 - d. Identification of Product being supplied
 - e. Location of where Product is to be Installed
 - f. Applicable Specification section number
2. Identify deviations from Contract documents clouding submittal drawings. Itemize and detail on separate 8-1/2 by 11-inch sheets entitled "DEVIATIONS FOR _____." When no deviations exist, submit a sheet stating no deviations exist.
3. Have design deviations signed and sealed by an appropriate design professional, registered in the State of Texas.
4. Sequentially number transmittal letters beginning with number one. Use original number for resubmittals with an alphabetic suffix (i.e., 2A for the first resubmittal of submittal 2, or 15C for third resubmittal of submittal 15, etc.). Show only one type of work or Product on each submittal. Mixed submittals will not be accepted.

C. Contractor's Stamp:

1. Apply Contractor's Stamp certifying that the items have been reviewed in detail by Contractor and that they comply with Contract requirements, except as noted by requested variances.
2. As a minimum, Contractor's Stamp shall include:
 - a. Contractor's name
 - b. Job number
 - c. Submittal number
 - d. Certification statement Contractor has reviewed submittal and it is in compliance with the Contract
 - e. Signature line for Contractor

D. Submittals will be returned with one of the following Responses:

1. "ACKNOWLEDGE RECEIPT" when no response and resubmittal is required.
2. "NO EXCEPTION" when sufficient information has supplied to determine that item described is accepted and that no resubmittal is required.
3. "EXCEPTIONS AS NOTED" when sufficient information has been supplied to determine that item will be acceptable subject to changes, or exceptions, which will be clearly stated. When exceptions require additional changes, the changes must be submitted for approval. Resubmittal is not required when exceptions require no further changes.
4. "REJECTED-RESUBMIT" when submittal does not contain sufficient information, or when information provided does not meet Contract requirements. Additional data or details requested by Project Manager must be submitted to obtain approval.

1.03 MANUFACTURER'S CERTIFICATES

- A. When required by Specification sections, submit manufacturers' certificate of compliance for review by Project Manager.
- B. Place Contractor's Stamp on front of certification.
- C. Submit supporting reference data, affidavits, and certifications as appropriate.
- D. Product certificates may be recent or from previous test results, but must be acceptable to Project Manager.

1.04 DESIGN MIXES

- A. When required by Specification sections, submit design mixes for review.
- B. Place Contractor's Stamp, as specified in this section, on the front of each design mix.
- C. Mark each mix to identify proportions, gradations, and additives for each class and type of mix submitted. Include applicable test results from samples for each mix. Perform tests and certifications within 12 months of the date of the submittal.
- D. Maintain copies of approved mixes at mixing plant.

1.05 CHANGES TO CONTRACT

- A. Changes to Contract may be initiated by completing a Request for Information form. Project Manager will provide a response to Contractor by completing the form and returning it to Contractor.
 - 1. If Contractor agrees that the response will result in no increase in cost or time, a Minor Change in the Work will be issued by City Engineer.
 - 2. If Contractor and Project Manager agree that an increase in time or cost is warranted, Project Manager will forward the Request for Proposal for negotiation of a Change Order.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

Section 01340

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Methods, schedules, and processes to be followed for Shop Drawings, Product Data and Sample submittals.

1.02 REQUIREMENT

- A. Submit Shop Drawings, Product Data and Samples as required by Document 00700 - General Conditions and Specification sections, using procedures specified in Section 01330 - Submittal Procedures and the requirements of this Section.
- B. Shop Drawings, Product Data and Samples are not considered Contract documents.

1.03 SHOP DRAWING/SUBMITTAL SCHEDULE

- A. Submit a separate Shop Drawing submittal schedule at same time the Construction Schedule is submitted. List Products for which Shop Drawings and other submittals are required in the order that they appear in Specifications. Include Product Data and Sample submittals in the schedule. Payment Applications or Certificates for Payment will not be processed until Project Manager has approved the Shop Drawing submittal schedule.

1.04 SHOP DRAWINGS

- A. Submit a minimum of seven sets of Shop Drawings and Product Data in a form and quality suitable for microfilming. Review and sign Shop Drawings indicating compliance with the Contract.
- B. Place Contractor's Stamp on each drawing as described in Section 01330 - Submittal Procedures.
- C. Show the following accurately and distinctly:
 - 1. Field and erection dimensions;
 - 2. Arrangement and section views;

3. Relation to adjacent materials or structure, including complete information for making connections between the Work and work under other contracts;
 4. Types of Products and finishes;
 5. Parts list and descriptions;
 6. Assembly drawings of equipment components and accessories showing respective positions and relationships to the complete equipment package;
 7. Identify details by referencing drawing sheet and detail numbers, schedule or room numbers as shown on the Contract drawings, where necessary for clarity.
- D. Scale drawings to provide a true representation of the specific equipment or item Furnished.
- E. Coordinate and submit components, necessary for Project Manager to adequately review submittal, as a complete package. Reproduction of the Drawings for use in Shop Drawings is not allowed.
- F. For major changes to original documents, submit Computer-Aided Design (CAD) drawings on a media acceptable to Project Manager.
- 1.05 PRODUCT DATA
- A. Submit Product Data for review as required in Specifications.
 - B. Place Contractor's stamp, on each data item submitted, as described in Section 01330 - Submittal Procedures.
 - C. Mark each copy to identify applicable Products, models, and options to be used in the Work. Where required by Specifications, supplement manufacturers' standard data to provide information unique to the Work.
 - D. Give manufacturers, trade name, model or catalog designation and applicable reference standard for Products specified only by reference standards.
 - E. Pre-approved and Pre-qualified Products.
 1. For "pre-approved", "pre-qualified" and "approved" Products named in the City standard products list, provide an appropriate list designation,

as described in Section 01630 - Product Substitution Procedures, within 30 days after Notice to Proceed.

2. For Products proposed as alternates to "approved" products, provide information required to demonstrate that the proposed Products meet the level of quality and performance criteria of the "approved" product.

1.06 SAMPLES

- A. Submit Samples for review as required by Specifications. Have Samples reviewed and signed by a Registered Professional.
- B. Place Contractor's stamp on each Sample or firmly attach a sheet of paper with Contractor's stamp, as described in Section 01330 - Submittal Procedures.
- C. Submit the number of Samples specified in Specifications; Project Manager will retain one.
- D. Reviewed Samples that may be used in the Work are identified in Specifications.

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 01351

ENVIRONMENTAL SAFETY AND WORKER PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

Environmental Safety and Worker Protection including monitoring emissions and exposure to workers and providing an appropriate response. The role of the Certified Industrial Hygienist (CIH) is also defined.

1.02 MEASUREMENT AND PAYMENT

No separate measurement and payment for work performed under this Section. The Contractor shall include the cost for this work in the contract bid price for work of which this is a component part.

1.03 REFERENCES

The following is a list of applicable requirements to this project. It is not intended to be a complete listing of all laws and regulations to which the Contractor must comply.

A. Code of Federal Regulations

1. 29 CFR 1910, "Occupational Safety and Health Standards".
 - a. 29 CFR 1910.146 "Permit-required confined spaces".
2. 29 CFR 1926, "Safety and Health Regulations for Construction" (Construction Industry Standards).
 - a. 29 CFR 1926.33 "Access to Employee Exposure and Medical Records".
 - b. 29 CFR 1926.51, "Sanitation Standard".
 - c. 29 CFR 1926.59, "Hazard Communication".
 - d. 29 CFR 1926.62, "Lead".
 - e. 29 CFR 1926.103 "Respiratory Protection".
3. 40 CFR 50, "National Primary and Secondary Ambient Air Quality

Standards"

- a. 40 CFR 50 Appendix B, "Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High Volume Method)".
 - b. 40 CFR 50 Appendix G, "Reference Method for the Determination of Lead in Suspended Particulate Matter Collected from Ambient Air".
4. 40 CFR 58, "Ambient Air Quality Surveillance".
 5. 40 CFR 60 Appendix A, "Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Fires".
 6. 40 CFR 117, "Determination of Reportable Quantities for Hazardous Substances".
 7. 40 CFR 122, "Administered Permit Program: The National Pollutant Discharge Elimination System".
- B. National Institute for Occupational Health and Safety
- NIOSH Method 7082, "Lead" (or equivalent).
- C. American Society for Testing and Materials
- ASTM D3335, "Test Method for Low Concentrations for Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy."
- D. EPA (Environmental Protection Agency) Publications
1. SW-846, "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods".
 2. EPA Method 3050, "Acid Digestion of Sediments, Sludges, and Soils".
- E. SSPC Guide 6, "Guide for Containing Debris Generated During Paint Removal Operations".
- F. SSPC Guide 7, "Guide for the Disposal of Lead Contaminated Surface Preparation Debris".
- G. SSPC Publication 91-18, "Industrial Lead Paint Removal Handbook".

H. Texas Commission on Environmental Quality

1. Texas Administrative Code (TAC) 30, Chapter 101, "General Rules".
2. Texas Administrative Code (TAC) 30, Chapter 111, "Control of Air Pollution from Visible Emissions and Particulate Matter".
3. Texas Administrative Code (TAC) 30, Chapter 290, "Water Hygiene".
4. Texas Administrative Code (TAC) 30, Chapter 307, "Surface Water Quality Standards".
5. Texas Administrative Code (TAC) 30, Chapter 309, "Effluent Limitations".
6. Texas Administrative Code (TAC) 30, Chapter 335, "Industrial Solid Waste and Municipal Hazardous Waste".

1.04 SUBMITTALS

- A. Submittals shall conform to requirements of Section 01330 – Submittal Procedures.
- B. Submittals shall conform to appropriate codes for regulatory requirements.

1.05 DEFINITION

- A. Acceptance Criteria: Minimum standards for the content of programs, plans, procedures, and designs required by this specification for the performance of this project. Acceptance criteria will be the basis for judging the responsiveness of Contractors' programs and will also be used as a basis for suspending work, if necessary.
- B. Action Level: Employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$) calculated as an eight hour time-weighted average (TWA).
- C. CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act; commonly called Superfund. Federal laws addressing the clean up of hazardous waste sites. Amended in 1986 by Superfund Amendments and Re-Authorization Act (SARA). EPA implementing regulations are contained in 40 CFR 300-373.
- D. Competent Person: One who is capable of identifying existing and predictable lead hazards in the surroundings or working conditions and who has authorization to take prompt corrective measures to eliminate them.

- E. Containment System: An enclosure built around lead paint removal areas designed to contain lead paint debris and prevent emissions to the environment.
- F. Dust Collection: Mechanical ventilation system designed specifically for the containment, capture, and removal of airborne particulate from the containment. Dust collection systems shall include ductwork, plenums and/or hoppers, and dust collector(s) for the removal of leaded paint dust from the air stream prior to discharging to the atmosphere.
- G. Emission: A release of material to the air, water, or ground.
- H. Entry/Exit Airlock: An isolated enclosure located at the entrance of the containment in which the workers remove contaminated dust and debris from their work clothes.
- I. EPA: The US. Environmental Protection Agency. Regulations are contained in Title 40 of the Code of Federal Regulations (40 CFR).
- J. Hazardous Waste (lead paint debris): Waste that is classified as hazardous due to its concentrations of regulated hazardous substances. Paint debris is classified as hazardous waste if, after testing by the Toxicity Characteristic Leaching Procedure (TCLP), the leachate contains any of the 8 metals or other substances in concentrations at or above limits established in 40 CFR 261.
- K. HEPA: A high efficiency particulate filter (HEPA) that is 99.97% efficient against particles of 0.3 microns in size or larger.
- L. Lead Containing Dust and Debris: Dust and debris generated during the project which contains lead in any amount, including but not limited to pulverized paint, spent abrasive, filters (wet and dry), and containment materials upon which lead is still present.
- M. NIOSH: National Institute of Occupational Safety and Health.
- N. OSHA: Occupational Safety and Health Administration. Standards are contained in Title 29 of the Code of Federal Regulations, Parts 1910 and 1926 (29 CFR 1910 and 29 CFR 1926).
- O. Owner: The City of Houston
- P. PEL: Permissible Exposure Limit. An employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 50 µg/m³ over an 8 hour TWA.
- Q. POTW: Publicly Owned Treatment Works

- R. RCRA: Resource Conservation and Recovery Act. Federal law pertaining to hazardous waste management. EPA implementing regulations are contained in 40 CFR 240-280.
- S. Regulated Area: Area established by the Contractor to demarcate the zone(s) beyond which airborne concentrations of lead do not exceed the Action Level.
- T. SSPC: Society for Protective Coatings. An independent, non-profit organization of engineers, technical specialists, and Contractors whose goal is research and development of new coatings and methods for removal, application, and disposal of existing coatings on industrial structures.
- U. Tarpaulins: Flexible fabric, vinyl, plastic or canvas cover sheets, impenetrable to dust, wind, and water, used to enclose the cable and/or scaffold support system comprising the containment enclosure.
- V. TCLP: Toxicity Characteristic Leaching Procedure. Laboratory tests conducted on wastes that determine the amount of hazardous materials that leach out into a test solution. The test is intended to simulate the properties of water as it leaches through a solid waste landfill. TCLP testing is defined in 40 CFR 261, Appendix II.
- W. TSP: Total Suspended Particulate

PART 2 PRODUCTS

2.01 MATERIAL AND EQUIPMENT

- A. The Contractor is to supply materials and equipment to insure the safety and protection of workers and the environment in accordance with these specifications.

PART 3 EXECUTION

3.01 ENVIRONMENTAL PROTECTION AND MONITORING

NOTE: Section 09971 "Painting and Protective Coatings", 2.04 "Containment System" specifically identifies containment system requirements.

- A. Protection of Ambient Air: Visible emissions are to be controlled to meet, as a minimum, TAC 30 Chapter 111, "Control of Air Pollution from Visible Emissions and Particulate Matter" requirements and SSPC-Guide 6I (CON), Level 1 Emissions. Air monitoring and analysis may be performed by the City during abrasive blast cleaning operations. Such monitoring will be in accordance with 40

CFR 50, Appendix B, "Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere" and/or 40 CFR 50, Appendix G, "Reference Method for the Determination of Lead in Suspended Particulate Matter Collected from Ambient Air". The limits for down wind pollutant concentrations allowed during blasting operations are as follows:

PM-10: 450 micrograms/cubic meter/ 8 hr.. (40 CFR 50.6)

Lead (Pb): 13.5 micrograms/cubic meter/8 hr.. (40 CFR 50.12)

Visible emissions and/or monitored emissions for PM-10 and TSP lead in excess of the above levels shall be cause for shut down of the project until corrections to control/ containment system or paint removal/ surface preparation operations are made to comply with these requirements.

B. Protection of Surface and Storm Water: The Contractor shall take all necessary precautions to ensure lead contaminants do not enter surface waters or storm water drainage systems.

1. The Contractor shall protect the area around ditches and drainage inlets. Daily verification of proper protection to minimize the potential contaminants reaching the drainage system shall be performed.
2. The Contractor shall collect all potentially contaminated process waters for testing and, as appropriate, treatment. Process water from pressure washing, wet abrasive blast cleaning or hygiene facilities shall not be discharged to drainage systems or surface waters.
3. The Contractor may remove lead or other heavy metals from such waters through filtration, ion exchange or other approved means. Following treatment, water samples must be tested prior to disposal. Discharge to sanitary sewer lines requires authorization, in writing, from a POTW.

C. Protection of Soil and Grounds: The Contractor shall protect the soil around the structure to ensure that the soil does not become contaminated. Where lead is present in the coatings to be removed, as indicated in Section 02136 "Waste Material Handling and Disposal", the Contractor shall provide for the sampling and analysis of soil samples for total lead content.

1. Sampling and analysis shall be performed prior to commencement of paint removal operations to establish a background "base level". Soil samples shall be taken 3 feet from the base of the tank(s), at a distance of 6-10 feet beyond the proposed containment structure and at the property line.
2. Samples from each area shall be taken in a minimum of four directions, at

- circular increments of 90⁰, one of which shall include the direction of prevailing wind. Samples shall also be obtained, at the direction of the engineer, at the closest points of public access (i.e. housing, park, school).
3. The soil sampling procedure shall be as outlined in SSPC Guide 6 Section 5.5.5. Each sampling point shall be sufficiently identified on a site map to allow return to the exact location upon project completion.
 4. Each sample shall be split in two portions, one for immediate analysis and the other sealed, preserved and furnished to the Engineer. The samples shall be analyzed in accordance with EPA Method 3050, "Acid Digestion of Sediments, Sludges and Soils", and shall be performed by a qualified laboratory approved by the Engineer.
 5. Samples shall be obtained at the completion of work (post-construction samples) from all locations from which pre-construction samples were obtained. Samples shall be collected, handled and tested in the same manner as described above.
 6. Upon completion of the work, soils found to be contaminated with lead in greater quantity than found in the background "base level", established at the start of the work, shall be removed by the Contractor to the depth necessary to achieve a lead content equivalent to, or below, the pre-construction back ground levels. Disposal shall be in accordance with applicable regulations.
 7. The Contractor shall replace in-kind (i.e., topsoil, structural fill, etc.) with an equivalent amount of non-contaminated soil, compact in place and grade to pre-existing conditions. The Contractor shall also replace in-kind any surface improvements, such as grass, shrubs, etc. that were damaged or destroyed by the work. The soil removal, replacement and related work is to be performed by the Contractor at no additional cost to the Owner.

3.02 WORKER PROTECTION

- A. The Contractor shall develop a written Compliance Program to establish and implement practices and procedures for assuring that no employee is exposed to lead at concentrations greater than 50 micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$), the OSHA permissible exposure limit (PEL). This program is in addition to other OSHA hazard communication and safety and health requirements of the project, and shall be revised and updated at least every six months.
 1. The program shall establish methods for complying with this specification and the OSHA Construction Industry Lead Standard, 29 CFR 1926.62(e)(2)(ii). The Federal regulation is referred to as the "Lead

Standard" for the purpose of this specification.

2. The program shall apply to all Contractor employees associated with lead on the project, and to subcontractors working under the direct control of the Contractor who are associated with lead on the project.
 3. The program shall assign the specific responsibility for implementation and enforcement of the program to the Contractors' company management. The Contractor's Competent Person(s) shall be identified, by name, and qualifications submitted. The Competent Person shall be on-site during any operations which involve the removal, handling or disturbing of lead containing materials.
 4. The program shall contain a description of each activity in which lead is emitted (e.g. equipment used, material involved, controls in place, crew size, employee job responsibilities, operating procedures and maintenance practices).
 5. The program shall contain a report of the technology considered in meeting the PEL and air monitoring data which documents the source of lead emissions.
 6. The program shall contain a work practice program which includes items required in the lead standard such as protective clothing and equipment, housekeeping, and hygiene facilities and practices.
- B. Exposure Monitoring: The Contractor shall be responsible for conducting and reporting worker exposure assessments in accordance with 29 CFR 1926.62.
1. Representative personal air samples shall be collected at the beginning of the lead removal work to determine employee lead exposures. Tasks involving potential lead exposure include, but are not limited to, paint removal operations, clean-up, and debris handling operations. Full shift (at least 7 hours) air samples shall be collected for each job classification in the exposure area. The range of exposures for lead removal and cleanup activities shall be determined.
 2. During the initial monitoring, workers performing the following activities (or equivalent) shall be protected to the anticipated exposure levels which are dictated by the lead standard:
 - a. 500 $\mu\text{g}/\text{m}^3$: Manual demolition of structures containing lead-containing coatings or paint (e.g., dry wall), manual scraping, manual sanding, heat gun applications, power tool cleaning with dust collection systems, and spray painting with lead paint.

- b. 2,500 $\mu\text{g}/\text{m}^3$: Using lead-containing mortar, lead burning, or conducting the following activities where lead-containing coatings or paint are present: rivet busting, power tool cleaning without dust collection systems, clean-up activities where dry expendable abrasives are used, and the movement and removal of abrasive blasting enclosures.
 - c. More than 2,500 $\mu\text{g}/\text{m}^3$: Activities involving lead containing coatings or paint on structures disturbed by abrasive blasting, welding, cutting, and torch burning.
 3. Protection requires compliance with the necessary respiratory protection, personal protective clothing and equipment, change areas and washing facilities, blood lead and zinc protoporphyrin monitoring, and employee training. The protection measures shall be modified, as necessary, after the exposure results are received.
 4. Where initial monitoring indicates that lead exposures are below the Action Level, and where work activities and conditions remain the same as at the time of initial sampling, additional monitoring need not be repeated for that work activity.
 5. Where the initial monitoring of a given work activity indicates that lead exposures are at or above the Action Level, additional exposure monitoring shall be conducted monthly. The monthly monitoring is more frequent than frequencies established in the lead standard which are at least every 6 months if above the Action Level, but below the PEL, or every 3 months if above the PEL.
 6. All air samples shall be collected and analyzed according to NIOSH Method 7082, or equivalent. All samples shall be analyzed by laboratories accredited by the American Industrial Hygiene Association for metals analysis.
 7. All exposed employees shall be notified in writing of the monitoring results within five (5) days after receiving the results.
 8. The Action Level for airborne lead exposure is 30 $\mu\text{g}/\text{m}^3$, as an 8-hour time weighted average (TWA) concentration, without regard to the use of respirators. Whenever workers' airborne lead exposures exceed the Action Level, the Contractor shall implement the following:
 - a. Periodic Exposure Monitoring
 - b. Employee Information and Training

- c. Employee Medical Surveillance and Medical Removal Protection
 - d. Housekeeping
 - e. Record keeping
 - f. Signs and Regulated Areas
9. The Permissible Exposure Limit (PEL) for airborne lead exposure is 50 $\mu\text{g}/\text{m}^3$, as an 8-hour TWA concentration. When the work area contains airborne lead levels above the PEL the Contractor shall implement the following in addition to those items listed in 3.02.B.8 of this section:
- a. Compliance Program
 - b. Respiratory Protection
 - c. Protective Clothing and Equipment
 - d. Hygiene Facilities and Practices
- C. Respiratory Protection: After feasible engineering controls and work practices have been implemented, respiratory protection shall be used to maintain employees' lead exposures below the PEL.
- 1. Respirators shall be worn by all employees, other Contractors, inspectors, or observers who enter regulated areas.
 - 2. The Contractor shall develop a written Respiratory Protection Program in compliance with 29 CFR 1910.134, paragraphs (b), (d), (e), and (f), and the lead standard. The program shall address the selection, use, maintenance, and inspection of respirators, and qualifications for respirator users.
- D. Protective Clothing and Equipment: The Contractor shall provide protective clothing and equipment and ensure they are worn by all employees whose lead exposures exceed the PEL, or who enter regulated areas.
- 1. Protective clothing shall include washable and/or disposable full body coveralls, gloves, foot coverings, and hoods. Other protective equipment shall include face shields, hard hats, eye protection, and hearing protection as appropriate.
 - 2. Disposable protective clothing shall be used for no more than one work day. Such clothing may have to be disposed of as hazardous waste.
 - 3. Reusable protective equipment shall be cleaned or replaced weekly if exposure levels are less than 200 $\mu\text{g}/\text{m}^3$, or daily if the exposure levels are greater than or equal to 200 $\mu\text{g}/\text{m}^3$.
 - 4. Clothing shall not be removed or "cleaned" by any means which could reintroduce the lead dust into the ambient air. This includes brushing,

shaking, and blowing. Vacuums equipped with HEPA filters shall be used for this purpose.

5. Reusable coveralls shall be collected at the end of each work day in closed containers. The containers shall be labeled in accordance with the requirements of 29 CFR 1926.62(g)(2)(vii). Contaminated clothing shall be cleaned in accordance with all applicable Federal, State, or local regulations pertaining to lead-contaminated laundry and water discharge. Laundries shall be informed that the clothing contains lead. If the clothing is washed on site, the discharge water shall be filtered, containerized, and arrangements made with the local POTW or other approved means of proper disposal.
 6. Protective clothing and equipment shall be removed in the contaminated section of the change area and shall not be worn into any clean areas.
 7. The Contractor shall provide the necessary clothing and equipment for use by the Owner and its designated representatives.
- E. Housekeeping: Accumulations of lead-containing dust and debris generated by work activities shall be removed and cleaned daily.
1. All persons doing the cleanup shall be trained in performing lead activities, respirator qualified, and participate in the medical surveillance program. Respirators and protective clothing shall be worn by all persons doing the cleanup.
 2. Compressed air may be used for housekeeping if used within containment and in conjunction with a ventilation system designed to capture the dust. Otherwise, HEPA-filtered vacuum cleaners shall be employed.
 3. All lead-containing dust and debris shall be collected in sealed containers. The waste shall be tested to determine whether it will be disposed of as hazardous waste.
- F. Personal Hygiene Facilities and Practices
1. Clean change areas shall be provided when employees' lead exposures exceed the PEL. The change areas shall be equipped with storage facilities for street clothing and a separate area for the removal and storage of lead-contaminated clothing and equipment. They shall be designed and used so that contamination of street clothing does not occur. Employees shall not leave the project site wearing any clothing worn while performing lead activities. Airborne lead exposures in the change area shall be maintained below the Action Level.

2. Shower facilities shall be provided whenever employees' lead exposures exceed the PEL. Shower facilities shall comply with OSHA Sanitation Standard, 29 CFR 1929.51. All employees whose lead exposures exceed the PEL shall shower at the end of each work shift or before leaving the project area. The shower facilities shall be made available for use by the Owner and its representatives, such as inspectors or observers.
3. Arrangements shall be made with the local POTW for the proper disposal of the shower and wash water after filtration (e.g., through a three stage 100, 50, and 5 micron filtering system), ion exchange, or other approved treatment technology.
4. Clean lunch areas shall be provided for all employees whose lead exposures exceed the PEL. Employees shall remove or clean (by vacuuming) their protective clothing and wash their hands and face before entering the lunch area. Lead exposures in the lunch area shall be maintained as free as practicable from lead contamination.
5. An adequate number of clean lavatory and hand washing facilities shall be provided. These shall comply with the OSHA Sanitation Standard, 29 CFR 1929.51.
6. Eating, drinking, smoking, chewing of food or tobacco products, or the application of cosmetics shall not be permitted in any areas where the lead exposures exceed the PEL. Thorough washing of hands and face is required prior to undertaking any of these activities.

G. Medical Surveillance and Medical Removal Protection

1. All employees who are exposed to lead above the Action Level in a single day during this project shall be provided with initial and periodic medical examinations and blood lead tests as required by the lead standard. A final blood lead test shall be provided for each worker upon completion of the project, or at any time a worker's employment at the project ceases.
2. When blood lead levels over 50 µg/dl are encountered, the Contractor shall provide for the temporary removal of employees from lead exposure above the Action Level. The required medical surveillance and periodic blood lead tests shall be provided in strict accordance with the lead standard throughout the removal.
3. Employees who will be required to wear a respirator or who request one shall be provided with a respirator and the necessary medical examinations to determine their ability to wear a respirator.

4. All examinations shall be provided by the Contractor and shall be performed by or under the direct supervision of a licensed physician.

H. Employee Information and Training

1. The Contractor shall provide lead training for all employees who are exposed to lead above the Action Level for this project.
2. The content of lead training shall include, as a minimum, those items listed in the lead standard.
3. Training shall also include hazard communication in accordance with 29 CFR 1926.59.
4. The Contractor shall notify other employers at the project site of the nature of the lead exposure work, the need to remain out of exposure areas, the warning sign and labeling system in effect, and the potential need for them to take measures to protect their employees.

I. Signs and Regulated Areas

1. The Contractor shall establish a regulated area surrounding activities where lead exposures exceed the Action Level. This includes locations where lead-containing debris is handled or transferred to storage containers.
2. The regulated area shall be demarcated by ropes, tape, walls, or containment's with caution signs posted at all accessible sides. Signs shall contain the legend:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

3. The Contractor shall control access of persons into regulated areas. Access shall be limited to individuals with proper training and personal protective equipment, and medical surveillance testing.
4. All persons entering regulated areas shall wear protective clothing and respirators.
5. Eating, drinking, smoking, and chewing of food or tobacco products shall be prohibited in regulated areas and in any area where lead exposures exceed the Action Level.

- J. Record keeping: All records relating to training, medical examinations, blood lead monitoring, and exposure monitoring shall be maintained by the Contractor as required by the lead standard. All records shall be available for review by the Owner or its representative upon request.

3.03 CERTIFIED INDUSTRIAL HYGIENIST (CIH)

- A. The Contractor shall provide for the services of a Certified Industrial Hygienist (CIH) who must be certified by the American Board of Industrial Hygiene in comprehensive practice.

- B. Duties of the CIH shall be as follows:

1. Conduct and/or verify training for contractor employees in accordance with 29 CFR 1926.62 (l).
2. Review and approve Contractor's Written Compliance Plan for conformance to 29 CFR 1926.62(e)(2)(ii) and this Specification.
3. Monitor and evaluate work weekly to assure conformance with the approved plan and that hazardous exposure is adequately controlled in accordance with worker safety and health requirements of these specifications
4. Provide monthly reports of work compliance with control requirements in regards to working in a lead environment.

- C. Activities of the CIH shall include:

1. Meet with City to discuss details of Contractor's Written Compliance Plan for lead paint removal.
2. Ensure worker and area air monitoring, testing and reporting are conducted by or under the direction of the CIH.
3. Furnish a detailed worker and area air monitoring schedule coordinated with Contractor's proposed production schedule.
4. Directing, monitoring and inspecting lead paint removal work to ensure that the requirements of the Contract have been satisfied during the entire lead paint removal operation.
5. Report results of air monitoring samples to the Engineer, signed by the CIH within 48 hours after the air samples are taken.
6. The CIH shall review sampling data, collected on a day when lead paint

removal operations occur, to determine if conditions require any change in work methods. Removal work shall not continue until approval is given by the CIH.

7. The CIH shall verify in writing and submit monitoring data to verify that:
 - a. Air borne lead levels at and beyond the lead control (regulated) area were and remained less than 30 mg/m³ of air
 - b. Contractor conformance to 29 CFR 1926.62 and Item 3.02, above
 - c. There were no visible accumulations of lead contaminated paint, dust or debris on the work site. Adjacent areas that may have become contaminated were properly cleaned and inspected.
 - d. The CIH shall verify that the work area and contractor's equipment have been adequately cleaned of lead contamination prior to demobilization from the work site.

3.04 DEMOBILIZATION

The Contractor shall not remove the lead control area, boundaries, warning signs, etc. prior to proper removal of all hazardous wastes, debris and materials from the site and the City's receipt and acceptance of the CIH's verification.

END OF SECTION

Section 01410

TPDES REQUIREMENTS

1.01 SECTION INCLUDES

- A. Documentation to be prepared and signed by Contractor/Operator before conducting construction operations, in accordance with the Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit Number TXR 150000 issued February 15, 2008 (the Construction General Permit).
- B. Implementation, maintenance inspection, and termination 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 appropriate practices shown on the Drawings or specified elsewhere in the Contract.
- C. Review of the Storm Water Pollution Prevention Plan (SWP3) implementation in a meeting with Project Manager prior to start of construction.

1.02 DEFINITIONS

- A. Commencement of Construction Activities: The exposure of soil resulting from activities such as clearing, grading, and excavation activities, as well as other construction related activities (e.g., stock piling of fill material, demolition).
- B. Large Construction Activity: Project that:
 - 1. disturbs five acres or more, or
 - 2. disturbs less than five acres but is part of a larger common plan of development that will disturb five acres or more of land.
- C. Small Construction Activity: Project that:
 - 1. disturbs one or more acres but less than five acres, or
 - 2. disturbs less than one acre but is part of a larger common plan of development that will ultimately disturb one or more acres but less than five acres.
- D. TPDES Operator:

Operator - The person or persons associated with a large or small construction activity that is either a primary or secondary as defined below:

Primary Operator – the person or persons associated with a large or small construction activity that meets either of the following two criteria:

- (a) the persons have operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications; or
- (b) the person or persons have day-to-day operational control of those activities at a construction site that are necessary to ensure compliance with a storm water pollution prevention plan (SWP3) for the site or other permit conditions (e.g., they are authorized to direct workers at a site to carry out activities required by the SWP3 or comply with other permit conditions).

Secondary Operator – The person whose operational control is limited to the employment of other operators or to the ability to approve or disapprove changes to plans and specifications. A secondary operator is also defined as a primary operators if there are no other operators if there are no other operators at the construction site.

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 SITE SPECIFIC STORM WATER POLLUTION PREVENTION PLAN (SWP3)

- A. Prepare a SWP3 following Part III of the Construction General Permit and the Storm Water Management Handbook for Construction Activities issued under City Ordinance Section 47-695(b). If conflicts exist between the Construction General Permit and the handbook, the more stringent requirements will apply.
- B. Update or revise the SWP3 as needed during the construction following Part III, Section E of the Construction General Permit.
- C. Submit the SWP3 and any updates or revisions to Project Manager for review and address comments prior to commencing, or continuing, construction activities.

3.02 NOTICE OF INTENT For Large Construction Activity

- A. Fill out, sign, and date TCEQ Form 20022 (03/05/2008) Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR 150000), **ATTACHMENT 1** of this Section 01410.
- B. Transmit the signed Contractor’s copy of TCEQ Form 20022 (03/05/2008), along with a \$325.00 check, made out to Texas Commission on Environmental Quality, and the completed Payment Submittal Form to Project Manager.

- C. Project Manager will complete a separate TCEQ Form 20022 (03/05/2008) for City's Notice of Intent, and will submit both Notices, along with checks for application fees, to the TCEQ.
- D. Submission of the Notice of Intent form by both the City and Contractor to TCEQ if mailing is required a minimum of seven days before Commencement of Construction Activities.

3.03 CONSTRUCTION SITE NOTICE FOR SMALL CONSTRUCTION ACTIVITY

- A. Fill out, sign, and date the Construction Site Notice, Attachment 2 to TPDES General Permit TXR 150000, "Construction Site Notice", **ATTACHMENT 2** of this Section 01410.
- B. Transmit the signed Construction Site Notice to Project Manager at least seven days prior to Commencement of Construction Activity.

3.04 CERTIFICATION REQUIREMENTS

- A. Fill out TPDES Operator's Information form, **ATTACHMENT 3** of this Section 01410, including Contractor's name, address, and telephone number, and the names of persons or firms responsible for maintenance and inspection of erosion and sediment control measures. Use multiple copies as required to document full information.
- B. Contractor and Subcontractors shall sign and date the Contractor's / Subcontractor's Certification for TPDES Permitting, **ATTACHMENT 4** of this Section 01410. Include this certification with other Project certification forms.
- C. Submit properly completed certification forms to Project Manager for review before beginning construction operations.
- D. Conduct inspections in accordance with TCEQ requirements. Ensure persons or firms responsible for maintenance and inspection of erosion and sediment control measures read, fill out, sign, and date the Erosion Control Contractor's Certification for Inspection and Maintenance. Use the City of Houston Storm Water Pollution Prevention Plan, Construction Site Inspection Report, **ATTACHMENT 5** of this Section 01410 to record maintenance inspections and repairs.

3.05 RETENTION OF RECORDS

- A. Keep a copy of this document and the SWP3 in a readily accessible location at the construction site from Commencement of Construction Activity until submission of the Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under TPDES Construction General Permit (TXR 150000). Contractors with day-to-day operational control over SWP3 implementation shall have a copy of the SWP3 available at a central location, on-site, for the use of all operators and those identified as having responsibilities under the SWP3. Upon submission of the NOT, submit all required forms and a copy of the SWP3 with all revisions to Project Manager.

3.06 REQUIRED NOTICES

- A. Post the following notices from effective date of the SWP3 until date of final site stabilization as defined in the Construction General Permit:
 - 1. Post the TPDES permit number for Large Construction Activity, with a signed TCEQ Construction Site Notice for large or Small Construction Activity. Signed copies of the City's and Contractor's NOI must also be posted.
 - 2. Post notices near the main entrance of the construction site in a prominent place where it is safely and readily available for viewing by General Public, Local, State, and Federal Authorities. Post name and telephone number of Contractor's local contact person, brief project description and location of the SWP3.
 - a. If posting near a main entrance is not feasible due to safety concerns, coordinate posting of notice with Project Manager to conform to requirements of the Construction General Permit.
 - b. If Project is a linear construction project (e.g.: road, utilities, etc.), post notice in a publicly accessible location near active construction. Move notice as necessary.
 - 3. Post a notice to equipment and vehicles operators, instructing them to stop, check, and clean tires of debris and mud before driving onto traffic lanes. Post at each stabilized construction access area.
 - 4. Post a notice of waste disposal procedures in a readily visible location on site.

3.07 ON-SITE WASTE MATERIAL STORAGE

- A. On-site waste material storage shall be self-contained and shall satisfy appropriate local, state, and federal rules and regulations.

- B. Prepare list of waste material to be stored on-site. Update list as necessary to include up-to-date information. Keep a copy of updated list with the SWP3.
- C. Prepare description of controls to reduce pollutants generated from on-site storage. Include storage practices necessary to minimize exposure of materials to storm water, and spill prevention and response measures consistent with best management practices. Keep a copy of the description with the SWP3.

3.08 NOTICE OF TERMINATION

- A. Submit a NOT, **ATTACHMENT 7** of this Section 01410, to Project Manager within 30 days after:
 - 1. Final stabilization has been achieved on all portions of the site that are the responsibility of the Contractor; or
 - 2. Another operator has assumed control over all areas of the site that have not been stabilized; and
 - 3. All silt fences and other temporary erosion controls have either been removed, scheduled to be removed as defined in the SWP3, or transferred to a new operator if the new operator has sought permit coverage.
- B. Project Manager will complete City's NOT and submit Contractor and City's notices to the TCEQ and MS4 entities.

END OF SECTION

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ATTACHMENT 1

	<p>Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR150000)</p> <p>For help completing this application, read the TXR150000 NOI Instructions (TCEQ-20022-Instructions).</p>	<p>TCEQ Office Use Only TPDES Permit Number: TXR15 _ _ _ _ - NO GIN Number: _ _ _ _ _ _ _ _ _ _ </p>
<p>A. Construction Site Operator <input type="checkbox"/> New <input type="checkbox"/> No Change Customer Reference Number: CN _____</p> <p>Name: _____</p> <p>Mailing Address: _____ City: _____ State: _____ Zip Code: _____</p> <p>Country Mailing Information (if outside USA) Territory: _____ Country Code: _____ Postal Code: _____</p> <p>Phone Number: _____ Extension: _____ Fax Number: _____</p> <p>E-mail Address: _____</p> <p>Type of Operator: <input type="checkbox"/> Individual <input type="checkbox"/> Sole Proprietorship - D.B.A. <input type="checkbox"/> Partnership <input type="checkbox"/> Corporation <input type="checkbox"/> Federal Government <input type="checkbox"/> State Government <input type="checkbox"/> County Government <input type="checkbox"/> City Government <input type="checkbox"/> Other: _____</p> <p>Independent Operator? <input type="checkbox"/> Yes <input type="checkbox"/> No Number of Employees: <input type="checkbox"/> 0-20 <input type="checkbox"/> 21-100 <input type="checkbox"/> 101-250 <input type="checkbox"/> 251-500 <input type="checkbox"/> 501 or higher</p> <p>Federal Tax ID: _____ State Franchise Tax ID Number: _____ DUNS Number: _____</p>		
<p>B. Billing Address</p> <p>Name: _____</p> <p>Mailing Address: _____ City: _____ State: _____ Zip Code: _____</p> <p>Country Mailing Information (if outside USA) Territory: _____ Country Code: _____ Postal Code: _____</p>		
<p>C. Project / Site Information <input type="checkbox"/> New <input type="checkbox"/> No Change Regulated Entity Reference Number: RN _____</p> <p>Name: _____</p> <p>Mailing Address: _____ City: _____ State: _____ Zip Code: _____</p> <p>Physical Address: _____ City: _____ County: - _____ Zip Code: _____</p> <p>Location Access Description: _____</p> <p>Latitude: ____° ____' ____" N Longitude: ____° ____' ____" W Degrees (°), Minutes ('), and Seconds (") Latitude: _____ Longitude: - _____ Decimal Form</p> <p>Standard Industrial Classification (SIC) code: _____ Also, describe the construction activity at this site (do not repeat the SIC code): _____</p> <p>Has a storm water pollution prevention plan been prepared as specified in the general permit (TXR150000)? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Estimated area of land disturbed (to the nearest acre): _____ Is the project / site located on Indian Country Lands? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Does this project / site discharge storm water into a municipal separate storm sewer system (MS4)? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>If yes, provide the name of the MS4 operator: _____</p> <p>Provide the name or segment number of the water body that receives storm water from this project / site: _____</p>		
<p>D. Contact - If the TCEQ needs additional information regarding this application, who should be contacted?</p> <p>Name: _____ Title: _____</p> <p>Phone Number: _____ Extension: _____ Fax Number: _____</p> <p>E-mail Address: _____</p>		
<p>E. Payment Information - Check / Money Order Number: _____ Name on Check / Money Order: _____</p>		
<p>F. Certification</p> <p>I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.</p> <p>Construction Site Operator:</p> <p>Prefix: _____ First: _____ Middle: _____ Last: _____ Suffix: _____ Title: _____</p> <p>Signature: _____ Date: _____</p> <p>If you have questions on how to fill out this form or about the storm water program, please contact us at (512) 239-4671. Individuals are entitled to request and review their personal information that the agency gathers on its forms. They may also have any errors in their information corrected. To review such information, contact us at (512) 239-3282.</p> <p>The completed NOI must be mailed to the following address. Use the attached document to submit the \$100 application fee. Please note that the NOI and application fee are submitted separately to different addresses.</p> <p style="text-align: center;">Texas Commission on Environmental Quality Storm Water & General Permits Team; MC - 228 P.O. Box 13087 Austin, Texas 78711-3087</p>		
TCEQ-20022 (05/03)	Page 1 of 2	

ATTACHMENT 1

**Texas Commission on Environmental Quality
Payment Submittal Form**

The storm water application fee shall be sent under separate cover to the Texas Commission on Environmental Quality.

This form must be used to submit your Storm Water Application Fee. Please complete the following information, staple your check in the space provided at the bottom of this document, and mail it to:

BY REGULAR U.S. MAIL

Texas Commission on Environmental Quality
Financial Administration Division
Cashier's Office, MC-214
P.O. Box 13088
Austin, TX 78711-3088

BY OVERNIGHT/EXPRESS MAIL

Texas Commission on Environmental Quality
Financial Administration Division
Cashier's Office, MC-214
12100 Park 35 Circle
Austin, TX 78753



Fee Code: GPA

Storm Water General Permit: TXR150000

Check / Money Order No: _____ Amount of Check/Money Order: _____

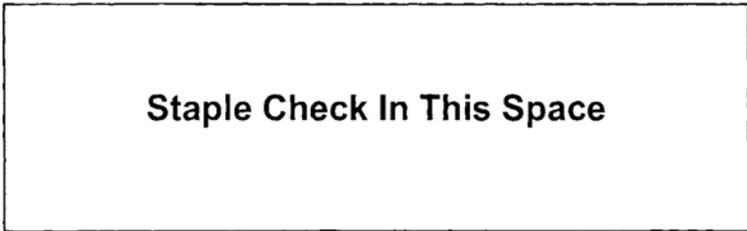
Date of Check or Money Order: _____

Name on Check or Money Order: _____

Facility / Site Name: _____

Facility / Site Physical Address: _____

City: _____ Zip Code: _____



ATTACHMENT 1

Completing the Notice of Intent for Storm Water Discharges
Associated with Construction Activity
under the TPDES Construction General Permit (TXR150000)

A. Construction Site Operator Information

Check boxes and Customer Reference Number

These boxes designate the operator's status as a TCEQ "customer"—in other words, an individual or business that is involved in an activity that we regulate. We assign each customer a number that begins with "CN," followed by nine digits. **This is not a permit number, registration number, or license number.** In the remainder of this section, we will use "this customer" to mean the operator for Part A of the form.

- If this customer has not been assigned a Customer Reference Number or if this number is unknown, check "New" and leave the space for the Customer Reference Number blank.
- If this customer has already been assigned this number, enter the operator's Customer Reference Number and:
 - Check "No Change" if all the remaining customer information is the same as previously reported. However, you must still complete most blanks in this form for this notice of intent to be valid.
 - If this customer's information has changed since the last time it was reported to the TCEQ, check neither box and complete the remainder of this notice of intent.
- **Do not enter a permit number, registration number, or license number in place of the Customer Reference Number.**

Name

Enter the legal name of this customer as authorized to do business in Texas. Include any abbreviations (LLC, Inc., etc.).

Mailing Address

Enter a central and general mailing address for this customer to receive mail from the TCEQ. For example, if this customer is a large company, this address might be the corporate or regional headquarters. On the other hand, for a smaller business, this address could be the same as the site address.

If this is a street address, please follow US Postal Service standards. In brief, these standards require this information in this order:

- the "house" number—for example, the 1401 in 1401 Main St
- if there is a direction before the street name, the one- or two-letter abbreviation of that direction (N, S, E, W, NE, SE, SW, or NW)
- the street name (if a numbered street, do not spell out the number—for example, 6th St, not Sixth St)
- an appropriate abbreviation of the type of street—for example, St, Ave, Blvd, Fwy, Exwy, Hwy, Cr, Ct, Ln
- if there is a direction after the street name, the one- or two-letter abbreviation of that direction (N, S, E, W, NE, SE, SW, or NW)
- if there is a room number, suite number, or company mail code

City, State, and ZIP Code

Enter the name of the city, the two-letter USPS abbreviation for the state (for example, TX), and the ZIP Code. (Enter the full ZIP+4 if you know it.)

Country Mailing Information

If this address is **outside** the United States, enter the territory name, country code, and any non-ZIP mailing codes or other non-U.S. Postal Service features here. If this address is **inside** the United States, leave these spaces blank.

Phone Number and Extension

This number should correspond to this customer's mailing address given earlier. Enter the area code and phone number here. Leave "Extension" blank if this customer's phone system lacks this feature.

Fax Number

This number should correspond to this customer's mailing address given earlier. Enter the area code and fax number here.

E-mail Address

As with the mailing address, this should be a general address that is appropriate for e-mail to this customer's central or regional headquarters, if applicable.

If "No Change" was checked for this customer, you may skip the rest of the fields in this part of the form and continue to the next part of the NOI.

Type of Operator

Check **only one** box.

Check ...	if this customer ...
Individual	is a person and has not established a business to do whatever causes them to be regulated by us.
Sole Proprietorship—D.B.A.	is a business that is owned by only one person and has not been incorporated. This business may: <ul style="list-style-type: none"> • be under the person's name • have its own name ("doing business as" or d.b.a.) • have any number of employees
Partnership	is a business that is established as a partnership as defined by the Texas Secretary of State's Office
Corporation	meets all of these conditions <ul style="list-style-type: none"> • is a legally incorporated entity under the laws of any state or country • is recognized as a corporation by the Texas Secretary of State • has proper operating authority to operate in Texas
Federal, state, county, or city government (as appropriate)	is either an agency of one of these levels of government or the governmental body itself (if a utility district, water district, tribal government, college district, council of governments, or river authority, check "Other" and write in the specific type of government.)
Other	fits none of the above descriptions. Enter a short description of the type of customer in the blank provided.

Independent Operator?

Check "No" if this customer is a subsidiary or part of a larger company. Otherwise, check "Yes."

Number of Employees

Check one box to show the number of employees for this customer's entire company, at all locations. **This is not necessarily the number of employees at the site named in this NOI.**

Federal Tax ID

All businesses, except for some small sole proprietors, should have a federal taxpayer identification number (TIN). Enter this number here. Use no prefixes, dashes, or hyphens. Individuals and sole proprietors do not need to provide a federal tax ID.

State Franchise Tax ID

Corporations and limited liability companies that operate in Texas are issued a franchise tax identification number. If this customer is a corporation or limited liability company, enter this number here.

DUNS Number

Most businesses have a DUNS (Data Universal Numbering System) number issued by Dun and Bradstreet Corp. If this customer has one, enter it here.

B. Billing Address

We will mail the annual fee invoice for this site to the address entered in this section.

Name

Enter the legal name of the person or business to which we should mail this site's fee invoice each year.

Mailing Address

Enter the specific mailing address to which we should mail this site's fee invoice each year. If this is a street address, please follow the US Postal Service standards as described under "A. Construction Site Operator Information" on page 1 of these instructions.

City, State, and ZIP Code

Enter the name of the city, the two-letter USPS abbreviation for the state (for example, TX), and the ZIP Code. (Enter the full ZIP+4 if you know it.)

Country Mailing Information

If this address is **outside** the United States, enter the territory name, country code, and any non-ZIP mailing codes or other non-U.S. Postal

ATTACHMENT 1

Service features here. If this address is *inside* the United States, leave these spaces blank.

C. Project / Site Information

Check boxes and Regulated Entity Reference Number

These boxes designate this site's status as a TCEQ "regulated entity"—in other words, a location where an activity that we regulate occurs. We assign each regulated entity a number that begins with "RN," followed by nine digits. *This is not a permit number, registration number, or license number.*

- If this site has not been assigned a Regulated Entity Reference Number or if this number is unknown, check "New" and leave the space for the Regulated Entity Reference Number blank.
- If this site has already been assigned this number, enter the Regulated Entity Reference Number and:
 - Check "No Change" if all the remaining information is the same as previously reported. However, even if there has been no change, you must complete this section at least through "E-mail Address" for this NOI to be valid.
 - If this site's information has changed since the last time it was reported to the TCEQ, check neither box and complete the remainder of this notice of intent.
- **Do not enter a permit number, registration number, or license number in place of the Regulated Entity Reference Number.**

Name

Enter the name by which you want this site to be known to the TCEQ.

Mailing Address

Enter the specific mailing address for this site. If this is a street address, please follow the US Postal Service standards as described under "A. Construction Site Operator Information" on page 1 of these instructions. If the project / site's mailing address is the same as what is provided in Section A, you may enter "Same as Section A".

City, State, and ZIP Code

Enter the name of the city, the two-letter USPS abbreviation for the state (for example, TX), and the ZIP Code. (Enter the full ZIP+4 if you know it.)

Physical Address

Enter the physical address of the site itself. TCEQ staff should be able to use this address to find the site. Please follow the US Postal Service standards as described under "A. Construction Site Operator Information" on page 1 of these instructions. If the project / site does not have a physical address, enter "No Address".

City, County, and ZIP Code

Enter the name of the city, the county, and the ZIP Code. (Enter the full ZIP+4 if you know it.) This information must be provided even if you have entered "No Address" in the previous field.

Location Access Description

Enter a physical description of the location of the site based on highway intersections and/or permanent landmarks.

Latitude and Longitude

Enter the latitude and longitude of the site in *either* degrees, minutes, and seconds *or* decimal form.

For help obtaining the latitude and longitude, go to:

<http://www.tnrc.state.tx.us/gis/drgview.html>

Standard Industrial Classification (SIC) Code and Activity Description

Provide the SIC code that best describes the construction activity being conducted at the site.

For help with SIC codes, go to:

<http://www.osha.gov/oshstats/sicser.html>

In addition to the SIC code, you must also provide a description of the construction activity being conducted at the site. This may include such descriptions as: "Apartment Building Construction" or "Shopping Center Construction."

Storm Water Pollution Prevention Plan

This plan identifies the areas and activities that could produce contaminated runoff at your site and then tells how you will ensure that this contamination is mitigated. For example, in describing your mitigation measures, your site's plan might identify the devices that collect and filter storm water, tell how those devices are to be maintained, and tell how frequently that maintenance is to be carried out. **You must develop this plan before you complete this NOI.** This plan must be available for a TCEQ investigator to review on request. Specific requirements for the development of the plan

can be found in the *Texas Pollutant Discharge Elimination System Construction General Permit (TXR150000)*.

Estimated Area of Land Disturbed

Provide the approximate number of acres that the construction site will disturb. It is appropriate to enter a value less than 5, only if the project is part of a larger common plan that disturbs five or more acres. If the acreage is less than 1, enter 1. "Disturb" means any clearing, grading, excavating, or other similar activities.

Is the site located on Indian Country Lands?

Check "Yes" only if the site is on a reservation or other areas designated by the federal government as Indian Country Lands. If not, check "No."

Destination of Storm Water Discharge

The storm water from your site eventually reaches a receiving water body such as a local stream or lake, possibly via a drainage ditch. The discharge may initially be into a municipal separate storm sewer system (MS4). Check the appropriate boxes for whether storm water is discharged into an MS4. If you checked "Yes" to "An MS4?", then enter the name of the entity that operates the storm sewer—often a city, town, or utility district, but possibly another form of government.

You must also provide the name of the water body that receives the discharge from the construction site (a local stream or lake). Storm water may be discharged directly to a receiving stream or via a storm sewer system. If known, please include the segment number if the discharge is to a classified water body.

For a map that includes segment numbers, go to:

<http://www.tnrc.state.tx.us/water/quality/data/index.html>

D. Contact

Give all the relevant information for the person whom TCEQ can contact if there are questions about any of the information on this form—perhaps the same person who completed the form.

E. Payment Information

Provide the number and account holder name from the check or money order used to pay the \$100 application fee.

F. Certification

The operator must sign and date this statement to validate this NOI. Be sure to enter the full legal name of the person signing the form and the relevant title—for example, "Operator," "Vice-President," or "Partner." Use the "Prefix" blank for such titles as Dr., Mr., or Ms., as desired. Use the "Suffix" blank for such designations as Ph.D., Jr., Sr., III, or J.D., if applicable.

For a corporation, the application shall be signed by a responsible corporate officer. A responsible corporate officer means a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation; or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures. Corporate procedures governing authority to sign permit applications may provide for assignment or delegation to applicable corporate positions rather than to specific individuals.

For a partnership or sole proprietorship, the application shall be signed by a general partner or the proprietor, respectively.

For a municipality, state, federal, or other public agency, the application shall be signed by either a principal executive officer or a ranking elected official. For purposes of this application, a principal executive officer of a federal agency includes the chief executive officer of the agency, or a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., regional administrator of the United States Environmental Protection Agency).

Questions?

If you have questions about any of the information on this form, contact our Storm Water Program at 512/239-4671 or look for "Storm Water" on our Web site:

www.tceq.state.tx.us

ATTACHMENT 2



CONSTRUCTION SITE NOTICE

FOR THE
Texas Commission on Environmental Quality (TCEQ)
Storm Water Program

TPDES GENERAL PERMIT TXR150000

The following information is posted in compliance with **Part II.D.2.** of the TCEQ General Permit Number TXR150000 for discharges of storm water runoff from construction sites. Additional information regarding the TCEQ storm water permit program may be found on the internet at:

www.tnrec.state.tx.us/permitting/waterperm/wwperm/tpdestorm

Contact Name and Phone Number:	
Project Description: <small>(Physical address or description of the site's location, estimated start date and projected end date, or date that disturbed soils will be stabilized)</small>	
Location of Storm Water Pollution Prevention Plan :	

For Construction Sites Authorized Under Part II.D.2. (Obtaining Authorization to Discharge) the following certification must be completed:

I _____ (Typed or Printed Name Person Completing This Certification) certify under penalty of law that I have read and understand the eligibility requirements for claiming an authorization under Part II.D.2. of TPDES General Permit TXR150000 and agree to comply with the terms of this permit. A storm water pollution prevention plan has been developed and implemented according to permit requirements. A copy of this signed notice is supplied to the operator of the MS4 if discharges enter an MS4 system. I am aware there are significant penalties for providing false information or for conducting unauthorized discharges, including the possibility of fine and imprisonment for knowing violations.

Signature and Title

Date

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ATTACHMENT 3

TPDES OPERATOR'S INFORMATION

Owner's Name and Address: City of Houston

Mr. _____
(City Official)

(Department)
P. O. Box 1562
Houston, Texas 77251-1562
(713) 247-1000

Contractors' Names and Addresses:

General Contractor: _____

Telephone: _____

Site Superintendent: _____

Telephone: _____

Erosion Control and
Maintenance Inspection: _____

Telephone: _____

Subcontractors' Names and Addresses:

Phone: _____

Phone: _____

Note: Insert name, address, and telephone number of person or firms

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ATTACHMENT 4

CONTRACTOR'S / SUBCONTRACTOR'S

CERTIFICATION FOR TPDES PERMITTING

I certify under penalty of law that I understand the terms and conditions of TPDES General Permit No. TXR150000 and the Storm Water Pollution Prevention Plan for the construction site identified as part of this certification.

Signature: _____
Name: (printed or typed) _____
Title: _____
Company: _____
Address: _____
Date: _____

Signature: _____
Name: (printed or typed) _____
Title: _____
Company: _____
Address: _____
Date: _____

Signature: _____
Name: (printed or typed) _____
Title: _____
Company: _____
Address: _____
Date: _____

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ATTACHMENT 5
EPA NPDES
Construction
Inspection Form



The following inspection is being performed in compliance with Part IV.D.4. of the NPDES Region 6 Storm Water Construction General Permit [63 Fed. Reg. 36502] and being retained in accordance with Part V of the Permit. Qualified personnel (provided by the permittee or cooperatively by multiple permittees) shall inspect disturbed areas of the construction site that have not been finally stabilized, areas used for storage of materials that are exposed to precipitation, placement and effectiveness of structural control measures, and locations where vehicles enter or exit the site. Inspections shall be performed at least once every 14 days and within 24 hours of the end of a storm event of 0.5 inches or greater. Where sites have been temporarily stabilized, runoff is unlikely due to winter conditions, or during seasonal arid periods in arid areas (0-10 inches of rainfall annually) and semi-arid areas (10-20 inches annually) such inspections shall be conducted at least once every month. This form is primarily intended for use with construction projects in Texas and New Mexico. Permittees on Indian Country lands in Oklahoma, Louisiana and Arkansas and some oil and gas facilities in Oklahoma may use this form if they are eligible for this permit. Other facilities need to check with their NPDES authority before using this form.

If you do not know your NPDES Permit Number, contact the NOI Processing Center at (301)495-4145. This form was prepared as an example and it is not a required form for use with the permit. Alternative forms may be used if they contain all of the required information as set forth in the permit. This form and additional information regarding the NPDES Region 6 storm water program may be found on the Internet at <http://www.epa.gov/region6/sw/>. Any person with a complaint about the operation of this facility in regards to this permit should contact EPA Region 6 at (214)665-7112.

Permit Number(s) covered by this inspection (e.g. owners, developers, general contractor, builders)	
Signature and Certification in accordance with Part VI.G of the permit:	<p>I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.</p> <p>Signature _____ Date _____</p>
Date of Inspection	
Inspector Name	
Is there a copy of the permit language with the SWPPP?	<input type="checkbox"/> YES <input type="checkbox"/> NO
Is the inspector qualified and are the qualifications documented in the SWPPP?	<input type="checkbox"/> YES <input type="checkbox"/> NO
Is an NPDES storm water construction sign posted at the entrance for all permittees?	<input type="checkbox"/> YES <input type="checkbox"/> NO
<p>You may want to use EPA Region 6 construction checklist to assure components of the SWPPP are complete. This form, the construction sign, and the checklist are available on the Region 6 NPDES Storm Water Forms and Documents web page which may be found on the internet at http://www.epa.gov/earth/r6/gen/w/formsw.htm. In addition to the checklist, you should provide a narrative (see next page) on the existing Best Management Practices and Structural Controls found during each inspection. Any problems identified in an inspection should be corrected within 7 days. The inspection should cover all components of the SWPPP and all potential pollutants. While eroded soil is the primary pollutant of concern, do not forget to inspect for other pollutant sources such as fuel tanks, paints, solvents, stabilization materials, concrete hardner, batch plants, and construction debris. The inspector will need to update the SWPPP to reflect findings of the inspection. The site map should be updated after an inspection to show controls that have been added or removed, to ensure the site map is kept current in accordance with Part IV.C. of the permit.</p>	

Revision 4, March 1, 2000

ATTACHMENT 5

Narrative Findings of the inspection:

Observations should include any findings of Best Management Practices or controls that are not in accordance with the SWPPP. If a control is not in place or failed, observe the reason why. A control removed temporarily for work is not necessarily a violation if properly recorded in the SWPPP. If it has been removed, record why it was removed and, if applicable, when it will be reinstalled. If the control has failed, observe the conditions so a conclusion may be made as to whether the control failed for improper maintenance or improper design. The qualified inspector will know when a failed control is inadequate and should be replaced by an improved control mechanism. Qualified inspectors are to have authority to make changes to the SWPPP to assure compliance. Controls that have not been installed should be given a reason why they are not installed and/or a scheduled date for installation if they are designed for a later phase of construction. After the inspection, the SWPPP and its site map should be updated to reflect current conditions of controls and Best Management Practices at the time of the inspection. This includes removing uninstalled controls from the site map or otherwise denoting on the site map if they are no longer installed if the controls have been removed because they are no longer necessary (e.g. stabilization has been achieved in that area).

Revision 4, March 1, 2000

01410-18
02-01-2011

ATTACHMENT 6



City of Houston
Storm Water Pollution Prevention Plan
Construction Site Inspection Report

TPDES/EPA Permit Number _____

COH Storm Water Quality Permit Number _____

DATE _____

No exceptions noted.

The following must be corrected prior to continuing work:

Public Notice improperly posted

Initial Construction Site Inspection Report information requires updating

Copy of NOI not on site

Storm water pollution prevention plan not on site

Erosion and sediment controls improperly installed

Erosion and sediment control devices improperly maintained

Fueling or washout areas not properly protected

Portocan or other sanitary facilities not properly protected

Self-inspection and maintenance records incomplete

Sediment from site outside area of construction

Other (see description below)

Please contact the Storm Water Quality Engineer at
611 Walker, RA-257, Houston TX 77002
713-837-7383 fax 713-837-0570

Once the above items have been corrected, call to arrange for reinspection. No further inspections for any construction related activity shall be made until the above items have been corrected.

Inspector's Signature

Contractor's Signature

Inspector's Name

Contractor's Name

not present

Distribution Stormwater Quality Engineer, Code Enforcement, Inspector, Operator
(Operator is Contractor)

Form _____ (10-01-01)

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ATTACHMENT 7

	Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR150000)	TCEQ Office Use Only
		TPDES Permit Number: TXR15: ___ ___ ___ ___ - NO GIN Number: ___ ___ ___ ___
For help completing this application, read the TXR150000 NOI Instructions (TCEQ-20023-Instructions).		
A. TPDES Permit Number: TXR15 _____		
B. Construction Site Operator		Customer Reference Number: CN _____
Name: _____		
Mailing Address: _____		
City: _____ State: -- _____ Zip Code: _____		
Country Mailing Information (if outside USA) Territory: _____ Country Code: _____ Postal Code: _____		
Phone Number: _____ Extension: _____ Fax Number: _____		
E-mail Address: _____		
C. Project / Site Information		Regulated Entity Reference Number: RN _____
Name: _____		
Physical Address: _____		
Location Access Description: _____		
City: _____ County: -- _____ Zip Code: _____		
D. Contact - If the TCEQ needs additional information regarding this termination, who should be contacted?		
Name: _____ Title: _____		
Phone Number: _____ Extension: _____ Fax Number: _____		
E-mail Address: _____		
E. Certification		
I certify under penalty of law that authorization under the TPDES Construction General Permit (TXR150000) is no longer necessary based on the provisions of the general permit. I understand that by submitting this Notice of Termination, I am no longer authorized to discharge storm water associated with construction activity under the general permit TXR150000, and that discharging pollutants in storm water associated with construction activity to waters of the U.S. is unlawful under the Clean Water Act where the discharge is not authorized by a TPDES permit. I also understand that the submittal of this Notice of Termination does not release an operator from liability for any violations of this permit or the Clean Water Act.		
Construction Site Operator Representative:		
Prefix: _____ First: _____ Middle: _____		
Last: _____ Suffix: _____		
Title: _____		
Signature: _____ Date: _____		
If you have questions on how to fill out this form or about the storm water program, please contact us at (512) 239-4671. Individuals are entitled to request and review their personal information that the agency gathers on its forms. They may also have any errors in their information corrected. To review such information, contact us at (512) 239-3282.		
The completed NOT must be mailed to the following address:		
Texas Commission on Environmental Quality Storm Water & General Permits Team; MC - 228 P.O. Box 13087 Austin, Texas 78711-3087		
TCEQ - 20023 (02/03) Page 1 of 1		

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ATTACHMENT 7

Completing the Notice of Termination for Storm Water Discharges
Associated with Construction Activity
under the TPDES Construction General Permit (TXR150000)

Who May File a Notice of Termination (NOT) Form

Permittees disturbing 5 acres or more (or part of a larger common plan of development or sale disturbing 5 acres or more) who are presently covered under the Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit must submit a Notice of Termination (NOT) when final stabilization has been achieved on all portions of the site that is the responsibility of the permittee; or another permitted operator has assumed control over all areas of the site that have not been finally stabilized and all silt fences and other temporary erosion controls have either been removed, scheduled for removal as defined in the SWP3, or transferred to a new operator if the new operator has sought permit coverage. Erosion controls that are designed to remain in place for an indefinite period, such as mulches and fiber mats, are not required to be removed or scheduled for removal.

Final Stabilization occurs when either of the following conditions are met:

- (a) All soil disturbing activities at the site have been completed and a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed.
- (b) For individual lots in a residential construction site by either:
 - (1) the homebuilder completing final stabilization as specified in condition (a) above; or
 - (2) the homebuilder establishing temporary stabilization for an individual lot prior to the time of transfer of the ownership of the home to the buyer and after informing the homeowner of the need for, and benefits of, final stabilization.
- (c) For construction activities on land used for agricultural purposes (e.g., pipelines across crop or range land), final stabilization may be accomplished by returning the disturbed land to its preconstruction agricultural use. Areas disturbed that were not previously used for agricultural activities, such as buffer strips immediately adjacent to a surface water and areas which are not being returned to their preconstruction agricultural use must meet the final stabilization conditions of condition (a) above.

A. TPDES Permit Number

Provide the TPDES permit number assigned to the operator of the construction site.

B. Construction Site Operator Information

Customer Reference Number

This number designates the operator's status as a TCEQ "customer"—in other words, an individual or business that is involved in an activity that we regulate. We assign each customer a number that begins with "CN," followed by nine digits. **This is not a permit number, registration number, or license number.** In the remainder of this section, we will use "this customer" to mean the operator for Part B of the form.

- If this customer has not been assigned a Customer Reference Number, leave the space for the Customer Reference Number blank.
- If this customer has already been assigned this number, enter the operator's Customer Reference Number.
- **Do not enter a permit number, registration number, or license number in place of the Customer Reference Number.**

Name

Enter the legal name of this customer as authorized to do business in Texas. Include any abbreviations (LLC, Inc., etc.).

Mailing Address

Enter a central and general mailing address for this customer to receive mail from the TCEQ. For example, if this customer is a large company, this address might be the corporate or regional headquarters. On the other hand, for a smaller business, this address could be the same as the site address.

If this is a street address, please follow US Postal Service standards. In brief, these standards require this information in this order:

- the "house" number—for example, the 1401 in 1401 Main St
- if there is a direction before the street name, the one- or two-letter abbreviation of that direction (N, S, E, W, NE, SE, SW, or NW)
- the street name (if a numbered street, do not spell out the number—for example, 6th St, not Sixth St)
- an appropriate abbreviation of the type of street—for example, St, Ave, Blvd, Fwy, Exwy, Hwy, Cr, Ct, Ln
- if there is a direction after the street name, the one- or two-letter abbreviation of that direction (N, S, E, W, NE, SE, SW, or NW)
- if there is a room number, suite number, or company mail code

City, State, and ZIP Code

Enter the name of the city, the two-letter USPS abbreviation for the state (for example, TX), and the ZIP Code. (Enter the full ZIP+4 if you know it.)

ATTACHMENT 7

Country Mailing Information

If this address is *outside* the United States, enter the territory name, country code, and any non-ZIP mailing codes or other non-U.S. Postal Service features here. If this address is *inside* the United States, leave these spaces blank.

Phone Number and Extension

This number should correspond to this customer's mailing address given earlier. Enter the area code and phone number here. Leave "Extension" blank if this customer's phone system lacks this feature.

Fax Number

This number should correspond to this customer's mailing address given earlier. Enter the area code and fax number here.

E-mail Address

As with the mailing address, this should be a general address that is appropriate for e-mail to this customer's central or regional headquarters, if applicable.

C. Project / Site Information

Regulated Entity Reference Number

This number designates this site's status as a TCEQ "regulated entity"—in other words, a location where an activity that we regulate occurs. We assign each regulated entity a number that begins with "RN," followed by nine digits. ***This is not a permit number, registration number, or license number.***

- If this site has not been assigned a Regulated Entity Reference Number, leave the space for the Regulated Entity Reference Number blank.
- If this site has already been assigned this number, enter the Regulated Entity Reference Number.
- ***Do not enter a permit number, registration number, or license number in place of the Regulated Entity Reference Number.***

Name

Enter the name by which you want this site to be known to the TCEQ.

Physical Address

Enter the physical address of the site itself. TCEQ staff should be able to use this address to find the site.

Location Description

Enter a physical description of the location of the site based on highway intersections and/or permanent landmarks.

City, County, and ZIP Code

Enter the name of the city, the county, and the ZIP Code. (Enter the full ZIP+4 if you know it.)

D. Contact

Give all the relevant information for the person whom TCEQ can contact if there are questions about any of the information on this form—perhaps the same person who completed the form.

E. Certification

The operator must sign and date this statement to validate this NOI. Be sure to enter the full legal name of the person signing the form and the relevant title—for example, "Operator," "Operator's attorney," or "Senior Site Manager." Use the "Prefix" blank for such titles as Dr., Mr., or Ms., as desired. Use the "Suffix" blank for such designations as Ph.D., Jr., Sr., III, or J.D., if applicable.

For a corporation, the application shall be signed by a responsible corporate officer. A responsible corporate officer means a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation; or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures. Corporate procedures governing authority to sign permit applications may provide for assignment or delegation to applicable corporate positions rather than to specific individuals.

For a partnership or sole proprietorship, the application shall be signed by a general partner or the proprietor, respectively.

For a municipality, state, federal, or other public agency, the application shall be signed by either a principal executive officer or a ranking elected official. For purposes of this application, a principal executive officer of a federal agency includes the chief executive officer of the agency, or a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g. regional administrator of the United States Environmental Protection Agency).

Questions?

If you have questions about any of the information on this form, contact our Storm Water Program at 512/239-4671 or look for "Storm Water" on our Web site:

www.tceq.state.tx.us

Section 01422

REFERENCE STANDARDS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Section includes general quality assurance as related to Reference Standards and a list of references.

1.02 QUALITY ASSURANCE

- A. For Products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on the date as stated in the General Conditions.
- C. Request clarification from Project Manager before proceeding should specified reference standards conflict with Contract documents.

1.03 SCHEDULE OF REFERENCES

AASHTO American Association of State Highway
and Transportation Officials
444 North Capitol Street, N.W.
Washington, DC 20001

ACI American Concrete Institute
P.O. Box 9094
Farmington Hills, MI 48333-9094

AGC Associated General Contractors of America
333 John Carlyle Street
Alexandria, VA 22314

AI Asphalt Institute
Research Park Drive
P.O. Box 14052
Lexington, KY 40512

REFERENCE STANDARDS**STANDARD GENERAL REQUIREMENT**

AITC	American Institute of Timber Construction 7012 S. Revere Parkway, Suite 140 Englewood, CO 80112
AISC	American Institute of Steel Construction One East Wacker Dr. Chicago, IL 60601
AISI	American Iron and Steel Institute 1101 17 th Street NW, Suite 1300 Washington, DC 20036
ASME	American Society of Mechanical Engineers Three Park Avenue New York, NY 10016
ANSI	American National Standards Institute 1819 L Street NW Sixth Floor Washington, D.C. 20036
APA	American Plywood Association Box 11700 Tacoma, WA 98411
API	American Petroleum Institute 1220 L Street, N.W. Washington, DC 20005
AREA	American Railway Engineering and Maintenance-of-Way- Association 8201 Corporate Drive, Suite 1125 Landover, Maryland 20785
ASTM	American Society for Testing and Materials 100 Barr Harbor Drive West Conshohocken, PA 19428
AWPA	American Wood-Preservers' Association P.O. Box 5690 Granbury, TX 76049
AWS	American Welding Society 550 NW 42 nd Avenue Miami, FL 33126

CITY OF HOUSTON
STANDARD GENERAL REQUIREMENT

REFERENCE STANDARDS

AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
COH	City of Houston P.O. Box 1562 Houston, TX 77251-1562
CLFMI	Chain Link Fence Manufacturers Institute 9891 Broken Land Parkway, Suite 300 Columbia, MD 21046
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Road Schaumburg, IL 60173-4758
EJMA	Expansion Joint Manufacturers Association 25 North Broadway Tarrytown, NY 10591
FS	Federal Standardization Documents General Services Administration Specifications Unit (WFSIS) 7th and D Streets, S.W. Washington, DC 20406
ICEA	Insulated Cable Engineer Association P.O. Box 440 S. Yarmouth, MA 02664
IEEE	Institute of Electrical and Electronics Engineers 445 Hoes Lane P.O. Box 440 Piscataway, NJ 08855-459
ISA	International Society of Arboriculture P.O. Box 3129 Champaign, IL 61826-3129
MIL	Military Specifications General Services Administration Specifications Unit (WFSIS) 7th and D Streets, S.W. Washington, DC 20406

REFERENCE STANDARDS

CITY OF HOUSTON
STANDARD GENERAL REQUIREMENT

NACE	National Association of Corrosion Engineers 1440 South Creek Drive Houston, TX 77084-4906
NEMA	National Electrical Manufacturers' Association 1300 North 17 th Street, Suite 1847 Rosslyn, VA 22209
NFPA	National Fire Protection Association 1 Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101
OSHA	Occupational Safety Health Administration U.S. Department of Labor Office of Public Affairs – Room N3647 Washington, DC 20210
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077-1083
PCI	Prestressed Concrete Institute 209 W. Jackson Blvd. Chicago, IL 60606
SDI	Steel Deck Institute P.O. Box 25 Fox River Grove, IL 60021
SSPC	Society for Protective Coatings (Steel Structures Painting Council) 40 24 th Street, Sixth Floor Pittsburgh, PA 15222
TAC	Texas Administrative Code Texas Water Resources Conservation Commission P. O. Box 13087 Library MC-196 Austin, TX 78711-3087
TxDOT	Texas Department of Transportation 125 East 11 th Street Austin, TX 78701-2483

UL	Underwriters' Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062
UNI-BELL	UNI-BELL Pipe Association 2655 Villa Creek Drive, Suite 155 Dallas, TX 75234

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 01450

CONTRACTOR'S QUALITY CONTROL

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Quality assurance and control of Installation and manufacturers' field services and reports.

1.02 QUALITY ASSURANCE AND CONTROL OF INSTALLATION

- A. Monitor quality control over Suppliers, manufacturers, Products, services, site conditions and workmanship, to produce work of specified quality at no additional cost to the City.
- B. Comply fully with manufacturers' Installation instructions, including each step in sequence.
- C. Request clarification from Project Manager before proceeding when manufacturers' instructions conflict with the Contract.
- D. Comply with specified standards as minimum requirements for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform the Work by persons qualified to produce a specified level of workmanship.

1.03 REFERENCES

- A. Obtain copies of standards and maintain at job site when required by individual Specification sections.

1.04 MANUFACTURERS' FIELD SERVICES AND REPORTS

- A. When specified in individual Specification sections, or as required by Project Manager, provide Product suppliers' or manufacturers' technical representative to observe site conditions, conditions of surfaces and Installation, quality of workmanship, start-up of equipment, operator training, testing, adjusting and balancing of equipment as applicable and to initiate required operation. Conform to minimum time requirements for start-up operations and operator training when provided in Specification sections.

CITY OF HOUSTON

CONTRACTOR'S QUALITY CONTROL STANDARD GENERAL REQUIREMENT

- B. At Project Manager's request, submit qualifications of manufacturers' representative to Project Manager 15 days in advance of required representatives' services. Representative is subject to approval by Project Manager.

- C. Manufacturer's representatives shall report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to a manufacturer's written instructions. Submit report within 14 days of observation to Project Manager for review.

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 01452

INSPECTION SERVICES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Inspection services and references

1.02 INSPECTION

- A. City Engineer will appoint an Inspector to represent the City and perform inspections, tests, and other services specified in individual Specification sections.
- B. City Engineer may also appoint, employ, and pay an independent firm to provide additional inspection or construction management services as indicated in Section 01454 - Testing Laboratory Services.
- C. The independent firm will submit reports to Project Manager, indicating observations and results of tests and indicating compliance or noncompliance with Contract requirements.
- D. Contractor shall assist and cooperate with the Inspector; furnish samples of materials, design mix, equipment, tools, and storage.
- E. Contractor shall notify Project Manager 24 hours prior to expected time for operations requiring services.
- F. Contractor shall sign and acknowledge reports for Inspector.

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 01454

TESTING LABORATORY SERVICES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Testing laboratory services and Contractor responsibilities related to those services.

1.02 REFERENCES

- A. ASTM C 1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- B. ASTM D 3666 - Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.
- C. 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.
- D. ASTM E 329 - Standard Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
- E. ISO/TEC Guide 25 - General Requirements for the Competence of Calibration and Testing Laboratories.

1.03 SELECTION AND PAYMENT

- A. The City will select, employ, and pay for services of an independent testing laboratory to perform inspection and testing identified in Part 3 of individual Specification sections.
- B. Contractor shall employ and pay for services of an independent testing laboratory or laboratories to perform inspection and testing identified in Part 2 of individual Specification sections.
- C. Employment of a testing laboratory by the City shall not relieve Contractor of its obligation to perform work in accordance with requirements of Contract documents.

TESTING LABORATORY SERVICES**STANDARD GENERAL REQUIREMENT**

- D. The City will deduct a minimum two-hour charge for testing laboratory time from periodic progress payment when operations requiring testing or inspection are canceled without prior notification.
- E. The City will deduct cost of retesting from periodic progress payment whenever failed work is removed, replaced and retested.

1.04 QUALIFICATION OF LABORATORY

- A. Meet laboratory requirements of ASTM E 329 and applicable requirements of ASTM C 1077, ASTM D 3666, and ASTM D 3740.
- B. Meet ISO/TEC Guide 17025 conditions for accreditation by the American Association for Laboratory Accreditation (A2LA) in specific fields of testing required in individual Specification sections.
- C. If laboratory subcontracts are part of the testing services, such work will be placed with a laboratory complying with the requirements of this Section.

1.05 LABORATORY REPORTS

- A. Testing laboratory shall provide and distribute copies of laboratory reports to the distribution list Project Manager provides at the pre-construction conference.
- B. Keep one copy of each laboratory report distributed or faxed at the site field office for duration of the Work.
- C. Laboratory will fax material supplier, Contractor and Project Manager reports that indicate failing test results by no later than close of business on the working day following test completion and review.

1.06 LIMITS ON TESTING LABORATORY AUTHORITY

- A. Laboratory may not release, revoke, alter, or enlarge requirements of the Contract.
- B. Laboratory may not approve or accept any portion of the Work.
- C. Laboratory may not assume Contractor duties.
- D. Laboratory has no authority to stop the Work.

1.07 CONTRACTOR RESPONSIBILITIES

- A. Provide safe access to the Work and to manufacturer's facilities for Project Manager and for testing laboratory personnel.
- B. Provide testing laboratory with a copy of the Construction Schedule and a copy of each update to Construction Schedule.
- C. Notify Project Manager and testing laboratory during normal working hours of the day previous to expected time for operations requiring inspection and testing services. When Contractor fails to make timely prior notification, do not proceed with the operations requiring inspection and testing services.
- D. Notify Design Consultant 24 hours in advance when Specification requires presence of Design Consultant for sampling or testing.
- E. Request and monitor testing as required to provide timely results and to avoid delays to the Work. Provide samples to laboratory in sufficient time to allow required test to be performed in accordance with specified test methods before intended use of the Product.
- F. 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 site or at source of Products to be tested, and to facilitate tests and inspections including storage and curing of test samples.
- G. Make arrangements with laboratory through Project Manager. Payment for additional testing will be made in accordance with Document 00700 - General Conditions:
 - 1. Re-testing required for failed tests.
 - 2. Re-testing for nonconforming work.
 - 3. Additional sampling and tests requested beyond specified requirements.
 - 4. Insufficient notification of cancellation of tests for work scheduled but not performed.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 CONDUCTING TESTING

- A Conform to laboratory sampling and testing methods specified in individual Specification sections to the latest issues of ASTM standards, TxDOT methods, or other recognized test standards as approved by Project Manager.

- B 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 employed testing laboratories.

END OF SECTION

Section 01502

MOBILIZATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mobilization of construction equipment and facilities onto the site.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Price Contracts. If Contract is Unit Price Contract, measurement for mobilization is on a lump sum basis.
- B. Stipulated Price (Lump Sum) Contract. If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

- C. Mobilization payments will be included in monthly payment estimates upon written application by Contractor subject to the following provisions:

- 1. Authorization for payment of 50 percent of that portion of Contract Price designated for mobilization will be made upon receipt and approval by Project Manager of the following items, as applicable:
 - a. Safety Program (Document 00700, Paragraph 10.1.1).
 - b. Site Utilization Plan (Section 01145).
 - c. Schedule of Values (Section 01292), if any.
 - d. Initial Construction Photographs (Section 01321), if needed.
 - e. Preliminary Construction Schedule and Billing Forecast (Section 01325).
 - f. Construction Schedule (Section 01325 or Section 01326, as applicable).
 - g. Submittal Schedule (Section 01330).
 - h. Site specific Storm Water Pollution Prevention Plan (SWPPP) and Notice of Intent (NOI) along with storm water application fee (Section 01410), if required.
 - i. Contractor's Quality Control Plan (Section 01450), if required.

- j. Establishment of a Field Office for Project Manager meeting requirements of Section 01520 - Temporary Field Office.
 - k. Traffic Control Plan (Section 01555), if required.
 - l. Plan for Control of Ground and Surface Water (Section 01578), if required.
 - m. Project Signs Submittal (Section 01580).
 - n. Trench Safety Program (Section 02260), if required.
 - o. Dewatering plan, when required.
2. Authorization for payment of the balance of that portion of Contract Price designated for mobilization will be made upon completion of the Work amounting to five percent of Original Contract Price. The amount of Contract Price designated for mobilization may not be applied in computing whether or not five percent of the Original Contract Price has been obtained.
3. Mobilization payments will be subject to retainage amounts stipulated in Document 00700 – General Conditions.

PART 2 PRODUCTS -Not Used

PART 3 EXECUTION -Not Used

END OF SECTION

Section 01504

TEMPORARY FACILITIES AND CONTROLS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Temporary facilities and necessary controls for the Project, including utilities, telephone, sanitary facilities, 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, pest and rodent control and disposal of trash, debris and excavated material.
- B. Facilities and controls specified in this section are considered minimum for the Project. Provide additional facilities and controls for proper execution of the Work and to meet Contractor's responsibilities for protection of persons and property.

1.02 MEASUREMENT AND PAYMENT

A. UNIT PRICES

- 1. No separate payment will be made for any temporary facilities and controls required under this section. Include cost of such work in contract price listed for mobilization.

1.03 CONTRACTOR'S RESPONSIBILITY

A. Comply with applicable requirements specified in other sections of Specifications.

- 1. Maintain and operate temporary facilities and systems to assure continuous service.
- 2. Modify and extend systems as the Work progress requires.
- 3. Completely remove temporary materials and equipment when no longer required.
- 4. Restore existing facilities used for temporary services to specified or original condition.

PART 2 P R O D U C T S - NOT USED

PART 3 EXECUTION

3.01 TEMPORARY UTILITIES

A. 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 Date of Substantial Completion. Included are fuel, power, light, heat, and other utility services necessary for execution, completion, testing, and initial operation of work.

B. 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. Water to be drawn from public fire hydrants. Obtain transit meter from City of Houston, Department of Public Works and Engineering, Taps and Meters Section. Pay required deposit based on rates established by latest ordinance.
3. Provide and maintain an adequate supply of potable water for domestic consumption by Contractor personnel, Project Manager and representatives of the City.

C. Electricity and lighting:

1. Provide electric power service required for the Work including required testing, lighting, operation of equipment, and other Contractor use.
2. Electric power service includes temporary power or generators required to maintain plant operations during scheduled shutdowns.
3. Minimum lighting level shall be 10 foot-candles for open areas; 20-foot-candles for stairs and shops. Provide a minimum of one 300-watt lamp for each 200 square feet of work area.

D. Temporary Heat and Ventilation:

1. Provide temporary heat 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.
- E. Telephone:
1. Provide emergency telephone service at Project site for use by Contractor personnel and others performing work or furnishing services at the site.
 2. Provide Houston-Metro lines, allowing unlimited calls, without charge in Greater Houston Metropolitan area with "call waiting" and "call forwarding" options. Provide one telephone answering machine with beepless remote message retrieval capability.
- F. Sanitary Facilities:
1. Provide and maintain sanitary facilities for persons on the site; comply with regulations of State and local departments of health.
 2. Enforce use of sanitary facilities by construction personnel at site. Enclose sanitary facilities. Pit-type toilets are not permitted. No discharge will be allowed from these facilities. Collect and store sewage and waste so as not to cause nuisance or health problems. Haul sewage and waste off-site and properly dispose in accordance with applicable 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.

3.02 STORAGE SHEDS AND BUILDINGS

- A. Provide adequately ventilated, watertight storage facilities with floor above ground level for Products susceptible to weather damage.
- B. Storage of Products not susceptible to weather damage may be on blocks off the ground.
- C. Store Products in a neat and orderly manner. Place Products to permit easy access for identification, inspection and inventory.
- D. Fill and grade site for temporary structures to provide drainage away from temporary and existing buildings.

3.03 SAFETY REQUIREMENTS

- A. Submit a safety program at the pre-construction meeting and follow the program in accordance with Document 00700 – General Conditions. Include documented response to trench safety requirements of Section 02260 - Trench Safety System.
- B. Conduct operations in strict accordance with applicable Federal, State and local safety codes and statutes and with good construction practice. Establish and maintain procedures for safety of all work, personnel and equipment involved in the Work.
- C. 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 Williams-Steiger Occupational Safety and Health Act of 1970, and to other legislation enacted for safety and health of Contractor employees. Safety and health standards apply to Subcontractors and Suppliers as well as to the Contractor.
- D. Observance of and compliance with safety regulations is Contractor's responsibility without reliance or superintendence of or direction by Project Manager. Immediately advise Project Manager of investigation or inspection by Federal Safety and Health inspectors of Contractor's or Subcontractor's work or place of work on site under the Contract, and after investigation or inspection, advise Project Manager of results. Submit one copy of accident reports to Project Manager within 10 days of occurrence.
- E. Protect areas occupied by workmen using the best available devices for detection of lethal and combustible gases. Test devices frequently to assure functional capability. Constantly observe infiltration of liquids into the Work area for visual or odor evidence of contamination, and immediately take appropriate steps to seal off entry of contaminated liquids to the Work area.
- F. Implement safety measures, including but not limited to safety personnel, first-aid equipment, ventilating equipment and other safety equipment specified or detailed on Drawings.
- G. Maintain required coordination with City Police and Fire Departments during entire period covered by the Contract.
- H. Include Project safety analysis in safety plan. Itemize major tasks and potential safety hazards. Plan to eliminate hazards or protect workers and public from each hazard.

3.04 FIRST AID EQUIPMENT

- A. Provide a first aid kit throughout the construction period. List telephone numbers for physicians, hospitals, and ambulance services in each first aid kit.
- B. Have at least one person thoroughly trained in first aid and CPR procedures present on the site when work is in progress. Contractor to conform to protocols and requirements for training and protection against "blood borne pathogens".

3.05 FIRE PROTECTION

- A. Conform to specified fire protection and prevention requirements established by Federal, State, or local governmental agencies and as provided in Safety Program.

3.06 SECURITY MEASURES

- A. Protect the Work, materials, equipment, and property from loss, theft, damage, or vandalism. Protect City property used in performance of the Contract.
- B. If existing fencing or barriers are breached or removed for purposes of construction, provide and maintain temporary security fencing equal to existing.

3.07 PROTECTION OF UTILITIES AND PIPELINES

- A. Prevent damage to existing public utilities during construction. Approximate locations of known utilities are shown on Drawings, but all lines may not be shown. Excavate with caution and repair lines damaged by construction operations.
- B. Use 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.
- C. Before excavating, locate underground utilities by appropriate means including the use of metal detection equipment, and probes, or by excavation or surveys. Repair damage caused by investigative work and by failure to locate or to preserve underground utilities.
- D. Give utility owners a minimum five days notice before commencing excavation to allow time to locate utilities and make adjustments or

relocations when they conflict with the Work. Include cost for temporary relocation of water, wastewater, and storm drainage lines, necessary to accommodate construction, in unit prices for utility construction unless otherwise noted. Bypassing of sanitary waste to storm drainage facilities is not allowed.

- E. Prior to excavation near pipelines, request a representative of the pipeline company to meet with Contractor and Project Manager at the site to discuss procedures to be used. Request pipeline company's representative to locate the pipelines in at least three locations: at each side and at centerline of proposed excavation of proposed utility. Also request representative and Project Manager to be present to observe Contractor operations when excavation is conducted within 15 feet of pipeline.
- F. Utility service lines are not shown on the construction document drawings. Contractor should anticipate that such service lines exist and should exercise extreme caution during construction. The utility service lines should be repaired and restored immediately as per the specification, if damaged due to any construction activities. No separate payment will be made for this repair and restoration work. Include payment in unit price for work in appropriate sections.
- G. Prior to abandonment of utility, make appropriate arrangements with City and owner of utility to terminate service, remove meters, transformers, and poles as may be required by site conditions.

3.08 PROTECTION OF THE WORK AND PROPERTY

A. Preventive Actions

- 1. Take necessary precautions and actions to prevent damage, injury, or loss to the Work or public and private property, including:
 - a. Storage of apparatus, supplies, and Products in an orderly, safe manner to limit interference with progress of the Work or work of other contractors, utility service companies, or the City's operations.
 - b. Suitable storage for Products subject to damage by exposure to weather, theft, breakage, etc.
 - c. Limitation of loading pressures imposed upon portions of the Work.
 - d. Frequent clean up of refuse, scrap materials, and debris from construction operations, necessary to maintain the site in a safe and orderly condition.

- e. Provision of barricades and guard rails to protect pedestrian and traffic around openings, scaffolding, temporary stairs and ramps, excavations, elevated walkways, and other hazardous areas.
 2. Protect public and private property adjacent to the site. Obtain written consent before entering or occupying privately-owned land except on easements provided for construction. Restore property damaged by construction operations to condition equal to or better than that existing before the damage.
- B. Barricades and Warning Systems
1. Where work is performed on or adjacent to roadways, rights-of-ways, or public land, provide barricades, fences, lights, warning signs, danger signals, and other precautionary measures necessary for protection of persons or property and for protection of the Work.
 - a. Erect sufficient barricades to keep vehicles and pedestrians from entering the Work. Paint barricades to be visible at night. From sunset to sunrise, provide at least one light at each barricade.
 - b. Maintain barricades, signs, lights, and provide watchmen until Project Manager approves removal. Whenever work creates encroachment onto public roadways, station flagmen to manage traffic flow in accordance with approved traffic control plan.
 - c. Conform to requirements of section 01555 – Traffic Control and regulation.
- C. PROTECTION OF EXISTING STRUCTURES
1. Underground Facilities
 - a. Known Underground Facilities are shown on the Drawings but all Facilities may not be shown. Explore sufficiently ahead of trenching and excavation work to locate Underground Facilities in order to prevent damage to them and to prevent interruption of utility services. Restore damage to Underground Facilities to original condition at no additional cost to the City.
 - b. If necessary to avoid unanticipated Underground Facilities, Project Manager may make changes in location of the Work.
 - c. If permanent relocation of an Underground Facility is required

and not provided for in the Contract documents, City Engineer will direct Contractor in writing to perform the Work under Modification provisions in Document 00700 - General Conditions.

2. Surface Structures include 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 level.
3. Protection of Underground Facilities and Surface Structures:
 - a. Support in place and protect Underground Facilities and Surface Structures located within or adjacent to the limits of the Work from damage. Install supports as required by the owner of the structure. Satisfy Project Manager that the owner of the facility or structure has approved methods and procedures before installing structure supports.
 - b. Avoid moving or changing public utility or private corporation property without prior written consent of a responsible official of the facility or structure. Allow representatives of utilities to enter the construction site for maintenance and repair purposes or to make necessary changes.
 - c. Notify utility and pipeline owners and operators of the nature of construction operations and dates when operations will be performed. When construction operations are required in immediate vicinity of existing structures, pipelines, or utilities, give a minimum of five working days advance notice. Probe and flag location of Underground Facilities prior to commencement of excavation. Keep flags in place until construction operations uncover the facility.
 - d. Assume risk for damages and expenses to Underground Facilities and Surface Structures within or adjacent to the Work.
- D. Employ a structural engineer to ensure protection measures are adequate for the safety and integrity of structures and facilities.
- E. 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 the Work.

2. Control traffic to prevent damage to Products and surfaces.
3. Provide coverings to protect Products from damage. Cover projections, wall corners, jambs, sills, and exposed sides of openings in areas used for traffic and passage of materials in subsequent work.

3.09 ROADS AND PARKING

- A. Prevent interference with traffic and operations of the City on existing roads.
- B. Designate temporary parking areas to accommodate construction and City personnel. When site space is not adequate, provide additional off-site parking. Locate as approved by Project Manager.
- C. Minimize use by construction traffic on existing streets and driveways.
- D. Do not allow heavy vehicles or construction equipment in existing parking areas.

3.10 ENVIRONMENTAL CONTROLS

- A. Use methods, equipment, and temporary construction necessary for control of environmental conditions at the site and adjacent areas.
- B. Comply with statutes, regulations, and ordinances relating to prevention of environmental pollution and preservation of natural resources including National Environmental Policy Act of 1969, PL 91-190, Executive Order 11514.
- C. Minimize impact to the surrounding environment. Do not use construction procedures that cause unnecessary excavation and filling of terrain, indiscriminate destruction of vegetation, air or stream pollution, or harassment or destruction of wildlife.
- D. Limit disturbed areas to boundaries established by the Contract. Do not pollute on-site streams, sewers, wells, or other water sources.
- E. Do not burn rubbish, debris or waste materials.

3.11 POLLUTION CONTROL

- A. Provide methods, means, and facilities necessary to prevent contamination of soil, water or the atmosphere by discharge of Pollutants from construction operations.
- B. Provide equipment and personnel to perform emergency measures to contain spillage, and to remove contaminated soils or liquids. Excavate and dispose of contaminated earth off-site in accordance with laws and regulations, and

replace with suitable compacted fill and topsoil.

- C. Provide systems necessary for control of Pollutants.
 - 1. Prevent toxic concentrations of chemicals.
 - 2. Prevent harmful dispersal of Pollutants into the environment.
- D. Use equipment that conforms to current Federal, State, and local laws and regulations.

3.12 PEST AND RODENT CONTROL

- A. Provide rodent and pest control as necessary to prevent infestation of construction or storage areas.
- B. Employ methods and use materials that will not adversely affect conditions at site or on adjoining properties.

3.13 NOISE CONTROL

- A. Provide vehicles, equipment, and use construction activities that minimize noise to the greatest degree practicable. Conform to noise levels of Chapter 30 –Noise and Sound Level Regulation, City Code of Ordinances, and latest OSHA standards. Do not permit noise levels to interfere with the Work or create a nuisance to surrounding areas.
- B. Conduct construction operations during daylight hours except as approved by Project Manager.
- C. Select construction equipment that operates with minimum noise and vibration. When directed by Project Manager, correct objectionable noise or vibration produced by operation of equipment at no additional cost to the City. Sound Power Level (PWL) of equipment shall not exceed 85 dbA (re: 10⁻¹² watts) measured five feet from the equipment, or at a lower level if prescribed by City Ordinances. Equipment noise requirements are contained in equipment specifications.

3.14 DUST CONTROL

- A. Use water or other methods approved by Project Manager to control amount of dust generated by vehicle and equipment operations.

3.15 WATER RUNOFF AND EROSION CONTROL

- A. Comply with requirements of section 01410 – TPDES Requirements.
- B. Conduct fill, grading and ditching operations and provide adequate methods necessary to control surface water, runoff, subsurface water, and water from excavations and structures in order to prevent damage to the Work, the site, or adjoining properties.
 - 1. Plan and execute construction and earthwork by methods that control surface drainage from cuts and fills, and from borrow and waste disposal areas.
 - 2. Minimize area of bare soil exposed at one time.
 - 3. Provide temporary control measures, such as berms, dikes, and drains.
 - 4. Provide, operate, and maintain equipment and facilities of adequate size to control surface water.
 - 5. Construct fill and waste areas by selective placement of materials to eliminate erosion of surface silts or clays that may erode.
 - 6. Direct water away from excavations, pits, tunnels, and other construction areas to prevent erosion, sedimentation or damage.
 - 7. Maintain existing drainage patterns adjacent to the site by constructing temporary earth berms, sedimentation basins, retaining areas, and temporary ground cover.
 - 8. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to the site or adjoining areas, in conformance with environmental requirements.
 - 9. Inspect earthwork periodically to detect any evidence of erosion. Take corrective measures as required to control erosion.

END OF SECTION

Section 01506

DIVERSION PUMPING

PART 1 G E N E R A L

1.01 DEFINITIONS

- A. Diversion-pumping: Installation and operation of bulkheads, plugs, hoses, piping, and pumps required to maintain sewer flow and prevent backups and overflows.

1.02 SYSTEM DESCRIPTION

- A. Provides continuous sewer service to users of sewer systems while maintenance or construction operations are in progress, by diverting flow around construction locations. Maintain sewer flow to prevent backup or overflow onto streets, yards and unpaved areas or into buildings, adjacent ditches, storm sewers, and waterways. Do not divert sewage outside of sanitary sewer system.
- B. When pumps are operating, have an experienced operator on site to monitor operation, adjust pumps, make minor repairs to system, and report problems.

1.03 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittals Procedures.
- B. For systems that bypass sanitary sewer line segments of 42-inch diameter or larger, submit a Diversion Pumping Plan prior to installation. Show location, number and size of pumps, number, location, size and type of hoses or rigid piping, and location of downstream discharge; and special features where pipes or hoses cross roadways, temporary trenches, support bridges.

1.04 SCHEDULING

- A. When the City operates or maintains diversion pumping in construction areas, coordinate construction activities with Project Manager.
- B. Cease operation of diversion pumping when approved by Project Manager.

PART 2 P R O D U C T S**2.01 MATERIALS**

- A. Design piping, joints and accessories to withstand at least twice maximum system pressure or 50 psi, whichever is greater.
- B. Use self-priming type or submersible electric pumps, with a working pressure gauge on the discharge. Pumps shall meet requirements of City of Houston Noise and Sound Level Regulations.

PART 3 E X E C U T I O N**3.01 FIELD QUALITY CONTROL**

- A. During diversion pumping, do not allow sewage to leak, dump, or spill into or onto areas outside of existing sanitary sewer systems.
- B. In the event of an accidental spill or overflow, immediately stop discharge and take action to clean up and disinfect spill. Promptly notify Project Manager so required reporting can be made to the Texas Commission on Environmental Quality (TCEQ) and the Environmental Protection Agency (EPA).

3.02 CLEANING

- A. When diversion-pumping operations are complete, drain sewage within piping into sanitary sewers prior to disassembly.

END OF SECTION

Section 01520

TEMPORARY FIELD OFFICE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A Temporary field office building and associated parking area.

1.02 FACILITY DESCRIPTION

- A Temporary field office to be utilized by authorized representatives of the City to coordinate and monitor daily construction activities performed by Contractor.
- B. Field office shall be a non-smoking facility.

PART 2 PRODUCTS

2.01 FIELD OFFICE

A General:

1. Locate office in vicinity of the Work at a location approved by Project Manager or where indicated on Drawings.
2. Furnish, Install and maintain field office for exclusive use of authorized representatives of the City. Provide sufficient room for Project meetings and Inspector's office.
3. Provide office within 10 days of Date of Commencement of the Work.
4. Construct two all-weather, hard surfaced parking spaces for exclusive use of authorized representatives of the City. Provide all-weather surfaced walk between parking spaces and field office.

B. Minimum Construction:

- 1 Structurally sound foundation and superstructure.

Weather tight with insulated roof, walls and 7-foot ceiling (minimum).

3. Stairs or walkway with handrail and covered entrance platform (minimum 4 feet by 4 feet) with mud scraper at door.
4. Resilient floor covering.
5. Screened windows with area equal to approximately 10 percent of floor area sufficient for light, view of the site, and ventilation. Provide each window with operable sash and burglar bars.
6. Secure exterior doors with dead-bolt cylinder locks and burglar bars.

C. Minimum Services:

1. Exterior entrance light.
2. Interior lighting of 75 foot-candles minimum 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. Three telephone service lines one for voice, one for data, and one for fax, for exclusive use of authorized representatives of the City.
7. Sanitary facilities in field office with one water closet, one lavatory, and one medicine cabinet for exclusive use of authorized representatives of the City.

D. Minimum Furnishings:

1. One 5-drawer desk
2. Two swivel desk chairs with casters.
3. One plan table.
4. One drawing plan rack.
5. One 4-drawer legal file cabinet complete with fifty legal-size hanging folders and two full-sized carriers.
6. One marker board with cleaner and markers.

7. Two waste baskets.
 8. One 30-inch by 36-inch tack board.
 9. One all-purpose fire extinguisher.
 10. Six protective helmets (hard hats) with ratchet adjustment for exclusive use of authorized representatives of the City.
 11. Conference table and chairs to accommodate 10 persons.
 12. All in one printer, copier, plain paper fax machine.
 13. Telephone instrument separate from fax machine.
- E. Provide adequate space for one set of Contract documents for ready reference.

PART 3 EXECUTION

3.01 MAINTENANCE

- A. Maintain all-weather surface driveway and parking areas, buildings, walkways, stairs and required furnishings and equipment for duration of the Contract.
- B. Provide janitorial services for duration of the Contract consisting of twice weekly sweeping and mopping floors, trash removal, weekly restroom cleaning, and weekly dusting of furniture and equipment.
- C. Provide soap, paper towels, toilet paper, cleansers and other necessary consumables.
- D. Immediately repair damage, leaks or defective service.

3.02 PROJECT CLOSEOUT

- A. Remove temporary field office and signs and restore site as specified in Section 01770 - Closeout Procedures.

END OF SECTION

SECTION 01554

TRAFFIC CONTROL AND STREET SIGNS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Materials, hardware and installation of Traffic Signs.

1.02 SUBMITTALS

- A. Contractor shall submit a list of intended suppliers and products to be used for all signs, posts, and associated hardware. City reserves the right to request actual product samples prior to approval.

1.03 MEASUREMENT AND PAYMENT

- A. Signs installed or replaced will be measured by the each sign. Signs refurbished will be measured by each sign.
- B. Payment for installation of traffic signs will be on the basis of each sign installed.
- C. The price is full compensation for furnishing and installing new signs and hardware. Cost of associated posts, footings, and miscellaneous mounting hardware will not be paid for directly but is to be included in the unit price bid for installation of each traffic sign.
- D. Non-standard signs installed or replaced will be measured by the square foot of the sign face. Non-standard signs shall not be installed without prior approval from the City.

PART 2 PRODUCTS

2.01 MATERIALS

- A. The following ASTM Standards and documents, of the issue in effect on the date of Invitation for Bid, form a part of this specification to the extent herein.
 - 1. ASTM B 209 Specification for Aluminum and Aluminum Alloy Sheet and Plate
 - 2. ASTM D 523 Standard Method for Test for Specular Gloss

3. ASTM D 4956 Standard Specification for Retroreflective Sheeting for Traffic Control
 4. ASTM E 284 Standard Definition of Terms Relating to Appearance of Materials
 5. ASTM E 308 Computing the Colors of Objects by Using the CIE System
 6. ASTM E 810 Standard Test Method for Coefficient of Retroreflection of Retroreflective Sheeting
 7. ASTM E 1164 Standard Practice for Obtaining Spectrophotometric Data for Object-Color Evaluation
- B. Substrate (Sign Blanks). This shall be aluminum alloy 5052-H38 and otherwise in conformance with ASTM B-209 and have gold chromate finish. The size, shape and thickness of the sign blanks are as indicated on the standard detail sheet in the plans or as specified by the Engineer.
1. Metal working. The aluminum shall be free of burrs and pits on both sides, including edges and holes, and shall be made ready for applications of the sheeting.
 2. Surface Preparation. The aluminum shall be thoroughly cleaned and degreased with solvent and alkaline emulsions cleaner by immersion, spray, or vapor degreasing and dried prior to application of the gold chromate sheeting coat. The aluminum shall be new and corrosion-free with holes drilled or punched, corners rounded to the radii shown in the standard detail sheet, and all edges smoothed prior to application of sheeting. The heavy or medium chromate coating shall conform in color and corrosion resistance to that imparted by the Alodine 1200F treatment.
 3. Size. The dimensions of substrate applications for regulatory, warning, and guide signs shall be as specified by the Engineer and as shown on the plans.
- C. Sign Face (Background, Legends, Symbols, and Colors). These shall be in accordance with the Standard Highway Sign Designs (SHSD) for Texas and with the Texas Manual of Uniform Traffic Control Devices (TMUTCD).
1. The sign face, made of electronic film and retro-reflective sheeting shall comply with the appearance, specification, and good workmanship designated by the using agency for sign faces constructed of screen processed retro-reflective sheeting of the same type.

2. All sign blanks shall be covered with appropriate retro-reflective sheeting.
 - a. All ground mounted stop signs, warning signs, and other regulatory signs, shall use at a minimum High Intensity Prismatic Reflective Sheeting.
 - b. All overhead signs shall use Diamond Grade Reflective Sheeting.
 - c. All other signs shall use Super Engineer Grade Sheeting
 3. Application Methods. The method of application of sheeting, letters, numbers, and symbols shall be precisely as prescribed in writing by the manufacturer.
 - a. Legend Spacing and Layout. Spacing and layout for all traffic control signs shall conform to the SHSD.
 - b. Tolerance for Horizontal Alignment. Letters, numerals, and symbols shall be horizontally aligned to a tolerance of 1/16 inch.
 - c. Tolerance for Vertical Alignment. Letters, numerals, and symbols shall be vertically aligned to a tolerance of 1/16 on each letter in each line.
- D. Sign Posts. Steel post shall conform to the standard specification for hot rolled carbon sheet steel, structural quality, ASTM designation A570, Grade 50. Average minimum yield strength after cold forming is 60,000 psi. The cross section of the post shall be square tube formed steel, carefully rolled to size and shall be welded directly in the corner by high frequency resistance welding or equivalent process and externally scarified to agree with corner radii. Sign posts shall be hot dipped galvanized conforming to ASTM A653, G90.
1. Installation. The square end of the post shall not be modified or pointed.
 - a. Flange. When sign post installation is required over building basements, bridges and cavities, a galvanized cast iron pipe flange shall be used. The base shall be 8 inches in diameter with six 5/16 inch holes drilled equidistant around the circumference, 5/8 inch from the outer edge. The neck of the flange shall be 3 inches in diameter, drilled and threaded to receive a 2 inch diameter galvanized post.
 - b. Hardware. All ground mounted signs shall be attached to posts using 5/16" nut and bolt assembly, the bolt being 2 1/2" in length. Stainless steel banding material, brackets and clips will be used for signs installed on light standards or mast arms.

- c. Construction. Anchors shall be anchored in a minimum of one cubic foot of class "C" concrete, 28 inches deep, with a 6 inch long, $\frac{3}{8}$ inch diameter pin inserted through the pre-drilled hole 3 inches from the bottom of the pole. Where the pole installation requires surface mounting, an 8 inch flange with a 2 inch threaded collar shall be used. The pole shall be galvanized, two inches in diameter and threaded to fit the flange. Sign placement and orientation shall be as specified in the construction plans.
- E. Each finished sign shall have the following sticker affixed to the back in a location where it will be visible when the sign is installed:



- The sticker shall be Zebra Technologies Z-Ultimate 3000 White or approved equal. Finished product shall be weather and fade resistant for the expected life of the sign.
- F. Warranty. The Contractor shall warrant the materials and workmanship of each sign in accordance with the maximum limits of material warranties extended by manufacturers of raw materials, subject to the conditions they specify. The retro-reflective sheeting will be considered unsatisfactory if it has deteriorated due to natural causes to the extent that: (1) the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions; or (2) the coefficient of retro-reflection is less than the minimum specified for that sheeting. When sign failure occurs prior to the minimum years indicated and an inspection demonstrates that the failure is caused by materials warranted to contractor to endure at least that long, the sign will be replaced or repaired free of materials charges. When failure occurs and inspection demonstrates that such failure is due to poor workmanship, the sign will be replaced or repaired at Contractor's expense, including shipping charges.

PART 3 EXECUTION

3.01.1 EQUIPMENT

- A. The contractor shall provide machinery, tools, and equipment necessary for proper execution of the work.

3.01.2 CONSTRUCTION

- A. Construction shall be high quality with no visible defects in the finished product. Fabrication shall be in accordance with these specifications. Street name signs shall always be supplied and installed at each project intersection whether signs previously existed at the location or not.
- B. The removal of existing signs shall be coordinated with the Traffic Operations Section of the Public Works Department (713-803-3054) and arrangements made for a convenient time to deliver City signs and poles. All salvaged traffic signs shall be delivered to the Traffic Operations Center located at 2200 Patterson Street. All deliveries to the Traffic Operations Center requires a minimum notice of two (2) working days prior to returning or delivering any sign and/or sign related material.

3.03 RESPONSIBILITIES

- A. The contractor is responsible for providing and supplying aluminum traffic signs covered with retro-reflective sheeting, applying standard legends (or special legends if shown in the plans) to the covered sign blanks, galvanized steel sign poles, pole anchors, all hardware for installing the signs and poles, and for installing traffic signs, poles and anchors as shown in the plans or call for in the contract documents, complete and ready for field installations.

END OF SECTION

Section 01555

TRAFFIC CONTROL AND REGULATION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Requirements for signs, signals, control devices, traffic barriers, flares, lights and traffic signals; construction parking control, designated haul routes, and bridging of trenches and excavations.
- B. Qualifications and requirements for use of flagmen.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Price Contracts.
 - 1. Traffic control and regulation. Payment for traffic control and regulation is on a lump sum basis. Include preparation and submittal of traffic control plan if different than shown on Drawings, and provision of traffic control devices, equipment, and personnel necessary to protect the Work and public. Payment will be based on Contractor's Schedule of Values for traffic control and regulation.
 - 2. Payment for traffic control will be authorized by Project Manager in three (3) parts. Partial payment will be made according to following schedule:
 - a. Payment of 25 percent of traffic control amount will be authorized when permanent control devices and necessary temporary markings, sufficiently deployed along job site as required to maintain progress of work, are installed at job site and approved. This limiting percentage will be prorated based upon extent of Contractor's setup.
 - b. A payment of 50 percent of traffic control amount will be authorized when pavement replacement commences. This limiting percentage will be prorated based upon linear footage, as measured along centerline axis of water main, of pavement replaced.
 - c. A payment of 25 percent of traffic control amount will be authorized when permanent pavement markings are restored and all unnecessary permanent and temporary control devices removed. This limiting percentage will be prorated based upon the extent of restoration.

3. Flagmen: Measurement is on a lump sum basis for flagmen as required for the project. The amount invoiced shall be determined based on the schedule of value submitted for flagmen.
4. New Portable Concrete Low Profile Traffic Barrier Provided. Payment is on a unit price basis for each linear foot of low profile traffic barrier provided, installed with hardware assemblies and connected together in accordance with the approved traffic control plan.
5. Portable Concrete Low Profile Traffic Barrier picked up from City of Houston Stockpile. Payment is on a unit price basis for each linear foot of low profile traffic barrier picked up from designated stockpile, moved onto the project, set at location and connected together.
6. Portable Concrete Low Profile Traffic Barrier Installed. Payment is on a unit price basis for each linear foot of low profile traffic barrier delivered to the project location, installed with hardware assemblies and connected together in accordance with the approved traffic control plan.
7. Portable Concrete Low Profile Traffic Barrier Moved and Reset. Payment is on a unit price basis for each linear foot of low profile traffic barrier disassembled, moved on the project, reset at the new locations and connected together. Include cost to repair roadway in the unit price.
8. Portable Concrete Low Profile Traffic Barrier Removed. Payment is on a unit price basis for each linear foot of low profile traffic barrier removed from the project, including hardware assemblies, and stockpiling at location listed in Section 01110 – Summary of Work. Include cost to repair roadway in the unit price.
9. Refer to Section 01270 - Measurement and Payment for unit price procedures.

- B. Stipulated Price Contracts. Include payment for work under this section in the total Stipulated Price.

1.03 REFERENCES

- A. Texas Manual on Uniform Traffic Control Devices (TMUTCD)
- B. Article 4413 (29bb), commonly referred to as Private Investigators and Private Security Agencies Act, and Article 2.12, Texas Code of Criminal Procedure.

- C. Code of Ordinances, City of Houston, Texas.
 - 1. Chapter 10 Buildings And Neighborhood Protection, Article X Cleanup After Demolition Or Removal Of Structures
 - 2. Chapter 40 Streets and Sidewalks, Article XVII Pedestrian Way Impairments

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Traffic control plan:
 - 1. If using traffic control plan contained in the Contract without modification, submit a letter confirming use of the plan.
 - 2. If using a different traffic control plan, submit the plan for approval. The plan must conform to TMUTCD requirements and be sealed by a Registered Texas Professional Engineer.
- C. Submit copies of approved lane closure permits issued by City Traffic Engineering Branch.
- D. Submit Schedules of Values for traffic control plan and flagmen within 30 days following Notice to Proceed.
- E. Submit records verifying qualifications of Uniformed Peace Officers and Certified Flagmen proposed for use on the Work.
- F. When working in the central business district, submit copies of approved Pedestrian Way permits issued by the City's Traffic Engineering Branch.

1.05 FLAGMEN

- A. Use Uniformed Peace Officers and Certified Flagmen to control movement of vehicular and pedestrian traffic when construction operations encroach on public traffic lanes. Unless otherwise approved by Project Manager, use Uniformed Peace Officer for work along major thoroughfares, schools, churches, hospitals and Work at signalized intersections.
- B. Uniformed Peace Officer: Individual employed full-time as a peace officer who receives separate compensation as a privately employed flagman. Private employment may be an employee-employer relationship or on an individual basis. Flagman may not be in the employ of another peace officer nor be a reserve peace officer.

1. Uniformed Peace Officers may be:
 - a. sheriffs and their deputies;
 - b. constables and deputy constables;
 - c. marshals or police officers of an incorporated city, town or village; or
 - d. as otherwise provided by Article 2.12, Code of Criminal Procedure.
 2. The Uniformed Peace Officer must be a full-time peace officer, must work a minimum average of 32 paid hours per week, and must be paid a rate not less than the prevailing minimum hourly wage rate set by the federal Wage and Hour Act. The individual must be entitled to vacation, holidays, and insurance and retirement benefits.
- C. Certified Flagman: Individual who receives compensation as a flagman and meets the following qualifications:
1. Formally trained and certified in traffic control procedures by the City's E. B. Cape Center.
 2. Speaks English. Ability to speak Spanish is desirable but not required.
 3. Paid for flagman duty at an hourly rate not less than the wage rate set for Rough Carpenter under the City's Wage Scale for Engineering Construction.
- D. Certified Flagmen must wear a distinctive uniform, bright-colored vest, and be equipped with appropriate flagging and communication devices while at the Work site. They must also have in their possession while on duty, a proof of training identification card issued by the appropriate training institute.

PART 2 PRODUCTS**2.01 SIGNS, SIGNALS, AND DEVICES**

- A. Comply with TMUTCD requirements.
- B. Traffic cones and drums, flares and lights: Conform to local jurisdictions' requirements.
- C. When working in the Central business district, provide pedestrian pathway

signage approved by the City's Traffic Engineering Branch.

2.02 PORTABLE LOW PROFILE CONCRETE BARRIERS

- A. The low profile concrete barrier is a patented design. Information concerning this barrier may be obtained from Texas Transportation Institute, Texas A&M University System, College Station, Texas 77843-3135, (409) 845-1712.

PART 3 EXECUTION

3.01 PUBLIC ROADS

- A. Submit requests forms for lane closure and sidewalk closure to the City's Traffic Engineering Branch at least three working days prior to need for blocking vehicular lanes or sidewalks. Do not block lanes or sidewalks without approved permits. Obtain application from the City's Traffic Engineering Branch at 611 Walker, 5th floor or at the following internet address: <http://www.ci.houston.tx.us/pwe/mrow/laneclosure.htm>.
- B. Follow laws and regulations of governing jurisdictions when using public roads. Pay for and obtain permits from jurisdiction before impeding traffic or closing lanes. Coordinate activities with Project Manager.
- C. Give Project Manager one-week notice before implementing approved traffic control phases. Inform local businesses of impending traffic control activities.
- D. Notified police department, fire department, METRO, and local schools, churches, and businesses in writing a minimum of five business days prior to beginning work.
- E. Maintain 10-foot wide all-weather lanes adjacent to the Work for emergency vehicle use. Keep all-weather lanes free of construction equipment and debris.
- F. Do not obstruct 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 Project Manager.
- G. Maintain local driveway access to residential and commercial properties adjacent to work areas at all times. Use all-weather materials approved by Project Manager to maintain temporary driveway access to commercial and residential driveways.
- H. Keep streets entering and leaving job site free of excavated material, debris, and foreign material resulting from construction operations in compliance with

applicable ordinances.

- I. Remove existing signage and striping that conflict with construction activities or that may cause driver confusion.
- J. Provide safe access for pedestrians along major cross streets.
- K. Alternate closures of cross streets so that two adjacent cross streets are not closed simultaneously.
- L. Do not close more than two consecutive esplanade openings at a time without prior approval from Project Manager.

3.02 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and the City's operations.
- B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.
- C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.03 FLARES AND LIGHTS

- A. Provide flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.04 HAUL ROUTS

- A. Utilize haul routes designated by authorities or shown on drawings for construction traffic.
- B. Confine construction traffic to designated haul routes.
- C. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

3.05 TRAFFIC SIGNS AND SIGNALS

- A. Construct necessary traffic control devices for temporary signals required to complete the Work including loop detectors, traffic signal conduits, traffic signal wiring and crosswalk signals. Notify the City's Traffic Engineering Branch a minimum of 60 days in advance of need for control boxes and switchgear. The City will perform necessary service, programming or adjustments, to signal boxes and switchgear if required during construction.

- B. Install and operate traffic control signals to direct and maintain orderly traffic flow in areas under Contractor's control affected by Contractor's operations. Post notices, signs and traffic controls before moving into next phase of traffic control.
- C. Relocate traffic signs and signals as the Work progresses to maintain effective traffic control.
- D. Unless otherwise approved by Project Manager, provide driveway signs with name of business that can be accessed from each crossover. Use two signs for each crossover.
- E. Replace existing traffic control devices in Project area.
- F. Project Manager may direct Contractor to make minor adjustments to traffic control signage to eliminate driver confusion and maintain orderly traffic flow during construction at no additional cost to the City.

3.06 BRIDGING TRENCHES AND EXCAVATIONS

- A. When necessary, construct bridges over trenches and excavation to permit an unobstructed flow of traffic across construction areas and major drives. Use steel plates of sufficient thickness to support H-20 loading and install to operate with minimum noise.
- B. Shore trench or excavation to support bridge and traffic.
- C. Secure bridging against displacement with adjustable cleats, angles, bolts or other devices when:
 - 1. bridging is placed over existing bus routes,
 - 2. more than five percent of daily traffic is comprised of commercial or truck traffic,
 - 3. more than two separate plates are used for bridging, and
 - 4. when bridge is to be used for more than five consecutive days.
- D. Extend steel plates used for bridging a minimum of 1 foot beyond edges of trench or excavation. Use temporary paving materials such as premix to feather edges of plates to minimize wheel impact on secured bridging.

3.07 REMOVAL

- A. Remove equipment and devices when no longer required.

B. Repair damage caused by installation.

C. Remove post settings to a depth of 2 feet.

3.08 TRAFFIC CONTROL, REGULATION AND DIRECTION

A. Use Flagmen to control, regulate and direct an even flow and movement of vehicular and pedestrian traffic, for periods of time as may be required to provide for public safety and convenience, where:

1. multi-lane vehicular traffic must be diverted into single lane vehicular traffic,
2. vehicular traffic must change lanes abruptly,
3. construction equipment must enter or cross vehicular traffic lanes and walks,
4. construction equipment may intermittently encroach on vehicular traffic lanes and unprotected walks and crosswalk,
5. traffic regulation is needed due to rerouting of vehicular traffic around the Work site, and
6. where construction activities might affect public safety and convenience.

B. Use of Flagmen to assist in the regulation of traffic flow and movement does not relieve Contractor of responsibility to take other means necessary to protect the Work and public.

3.09 INSTALLATION STANDARDS

A. Place temporary pavement for single lane closures, in accordance with TMUTCD.

B. Reinstall temporary and permanent pavement markings as approved by Project Manager. When weather conditions do not allow application according to manufacturer's requirements, alternate markings may be considered. Submit proposed alternate to Project Manager for approval prior to installation. No additional payment will be made for use of alternate markings.

3.10 MAINTENANCE OF EQUIPMENT AND MATERIAL

A. Submit name, address and telephone number of individual designated to be

responsible for maintenance of traffic handling at construction site to Project Manager. Individual must be accessible at all times to immediately correct deficiencies in equipment and materials used to handle traffic including missing, damaged, or obscured signs, drums, barricades, or pavement markings.

- B. Inspect signs, barricades, drums, lamps and temporary pavement markings daily to verify that they are visible, in good working order, and conform with traffic handling plans as approved by Project Manager. Immediately repair, clean, relocate, realign, or replace equipment or materials that are not in compliance.
- C. Keep equipment and materials, signs and pavement markings, clean and free of dust, dirt, grime, oil, mud, or debris.
- D. Obtain approval of Project Manager to reuse damaged or vandalized signs, drums, and barricades.

END OF SECTION

Section 01562

TREE AND PLANT PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tree and plant protection.
- B. Minimum qualifications of Arborist and Urban Forester.

1.02 MEASUREMENT AND PAYMENT

- A. Payment for Tree Protection, including tree pruning or tree removal, shall be paid as a Lump Sum basis that shall include all items specified in this section unless payment is specified otherwise in this section
- B. Payment for Zero Curb Cutback will be on a per linear foot basis.
- C. Payment for Checker Plate will be on a square foot basis.
- D. Refer to Section 01270-Measurement and Payment for unit price procedures.

1.03 SUBMITTALS

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Submit name and experience of qualified Arborist, proposed for use on the Work, to Project Manager.

1.04 PROJECT CONDITIONS

- A. Preserve and protect existing trees and plants to remain from foliage, branch, trunk, or root damage that could result from construction operations.
- B. Prevent following types of damage:
 - 1. Compaction of root zone by foot or vehicular traffic, or material storage.
 - 2. Trunk damage from equipment operations, material storage, or from nailing or bolting.

3. Trunk and branch damage caused by ropes or guy wires.
4. Root or soil contamination from spilled solvents, gasoline, paint, lime slurry, and other noxious materials.
5. Branch damage due to improper pruning or trimming.
6. Damage from lack of water due to:
 - a. Cutting or altering natural water migration patterns near root zones.
 - b. Failure to provide adequate watering
7. Damage from alteration of soil pH factor caused by depositing lime, concrete, plaster, or other base materials near roots zones.
8. Cutting of roots larger than one inch in diameter.

1.05 DAMAGE ASSESSMENT

- A. When trees other than those designated for removal are destroyed or damaged as result of construction operations, remove and replace with same size, species, and variety up to and including 8 inches in trunk diameter. Trees larger than 8 inches in diameter shall be replaced with an 8 inch diameter tree of the same species and variety and total contract amount will be reduced by an amount determined from the following formula and paid to Tree Fund $0.7854 \times D^2 \times \13.25 where D is diameter in inches of tree or shrub trunk measured 12 inches above grade for that portion of the tree which is greater than 8 inches in diameter. A permit must be applied for and approved by the City of Houston, Urban Forestry Division prior to removal of any tree not scheduled for removal in the tree treatment schedule. Contractor shall contact City of Houston, Urban Forestry, at 832-395-8459 to apply for tree removal permit when needed.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Pruning Paint: Black latex, water based paint, free of all petroleum products.
- B. Fertilizer: Fertilizer shall be a root stimulant that contains at a minimum the following ingredients: Ectomycorrhizal Fungi, VA Mycorrhizal (VAM) Fungi, Rhizosphere Bacillus spp., Kelp Meal Humic Acid, and Soluble Yucca.

- C. Tree Protection Fencing: Orange, plastic mesh fencing, 4 feet in height with 6 feet high “t” bar posts installed 10 feet on centers as per drawings.
- D. Plastic Root/Soil Protection: Clear polyethylene sheeting, minimum 6 mil, thickness.

PART 3 EXECUTION

3.01 PROTECTION OF EXISTING TREES AND SHRUBS

- A. Site preparation work and/or construction work shall not begin in any area where tree preservation measures have not been completed and approved.
- B. Protect exposed roots and root zone areas from contamination from stabilization materials and concrete using polyethylene.
- C. Cover exposed roots within 4 hours to reduce damage caused by desiccation. Roots may be covered with soil, mulch, polyethylene, or wet burlap to help protect them from drying.
- D. Designate limited areas as concrete washout areas. Locate concrete washout areas away from root zones.
- E. Install root pruning trenching where designated in tree treatment schedule and shown on the tree protection drawings. Trees scheduled for root pruning are called out specifically in the treatment schedule. Trench shall be located 2 ft. from the edge of proposed waterline or sanitary sewer for trees called out for root pruning for water or fittings, or sanitary sewer in the treatment schedule, 2 ft. from edge of proposed storm sewer pipe for trees called out for root pruning for storm in the treatment schedule, 30” back of proposed curb for trees called out for root pruning for street, and at edge of sidewalk for trees called out for root pruning for sidewalk. Root pruning shall not be performed where there is not adequate space to be located sufficiently away from tree to prevent damage. All pruning must be evaluated by Contractor’s Certified Arborist and reviewed and approved by City Forester before being performed. Trench locations shown on tree preservation plan are drawn to scale and should be located in field as drawn on plan. Exact locations shall be approved in the field by engineer and/or project urban forester prior to installation. Trenching depth shall be a minimum of 2 ft. deep and a maximum of 6 inches wide for water, fittings, sanitary sewer, storm, and street. Trenching depth shall be to the anticipated bottom of sidewalk and base material for sidewalk root pruning, roots lower than sidewalk shall not be pruned. All roots shall be cut by trencher, chainsaw, or handsaw to the specified depth. Roots shall be cut cleanly, and or not ripped, torn, or chopped. Trench shall be backfilled and compacted immediately after trenching. Trench shall be installed prior to any clearing and grubbing, excavation for underground, or any other site work.

- F. Install tree protection fencing around each tree to be preserved as indicated in the tree treatment schedule and on the tree protection plan.
1. Each tree to be preserved shall be protected with a tree protection fence. The fencing shall be continuous between posts, shall be pulled taut prior to securing to posts, and shall be firmly attached to the posts with a minimum of 4 wire ties.
 2. All tree protection fencing shall be installed prior to site work or construction activity. The fence shall be placed in a continuous alignment as shown on the tree protection plan. Fences shown on tree protection plan are drawn to scale and shall be installed as drawn, in the field. In general fences shall be placed 30” back of existing curb or edge of pavement where root pruning or zero curb cutback is not specified, and 6” back of root pruning trench where root pruning is specified and immediately back of curb where zero curb cutback is specified. Exact locations shall be approved by the project urban forester and/or engineer in the field. The Fences shall be placed to protect roots, trunks, and foliage. The contractor shall not remove or relocate tree protection fencing and shall not operate within the limits shown without direct approval of the project urban forester. In areas where the proposed waterline is located in the existing road side ditch and where tree protection fencing can not be installed across the ditch, the fencing shall be installed at the top of outside ditch bank and no bore pits, peep holes, service taps, or any excavation should occur in the area immediately in front of the tree protection fencing for trees called out with “bore” in the Tree Treatment Schedule. The “bore” limits shall be the same as the limits of the tree protection fencing.
 3. Storage of equipment or materials will not be allowed inside a fence. Entryways and access into a protected area shall not be provided unless approved by the project urban forester.
 4. Damage to tree fences occurring during the progress of the work shall be repaired immediately at no additional cost to owner. Workmen shall be clearly instructed to exercise caution in performance of work near trees being preserved.
 5. Tree protection fencing shall be removed by contractor, at no additional costs, upon completion of all construction activity in each work zone area. Tree protection fencing materials used in the first two work zone areas shall be removed and utilized in subsequent work zone areas. Materials and labor shall be paid for each linear foot of fencing installed in first two work areas. All fencing installed in subsequent work zone areas shall be paid for labor only.
- G. Boring/Auguring of water lines or sanitary sewer lines
1. Water line or sanitary sewer line shall be bored/augured/ horizontally drilled under

critical root zones areas of trees designated with auger or bore in the tree treatment schedule. The entire area protected with tree protection fencing shall be bored. No bore pits, come through holes, peep holes, push pits, or long or short side service taps shall be allowed in the areas protected by tree protection fencing. The tree protection plan takes into consideration the limits of augering equipment, there should be room for adequately spaced bore pits, peep holes, come through holes, and push pits. Any changes to the location of the tree protection fencing shall be authorized by the project Urban Forester and City Engineer.

H. Hand digging of Service taps and leads

1. Trees called out for Hand dig short side service tap are located in very close proximity to existing short side water meters. Excavating the service tap with machinery would significantly impact the tree and be in violation of the City of Houston's Street Tree Ordinance. These short side service taps shall be excavated with manual labor to expose any roots 1" in diameter and larger. The first 24" of excavation shall be completed manually to expose the roots. Any root 1" in diameter and larger shall remain undamaged, the roots shall not be cut, nor shall the bark and cambium layer be scraped or damaged. Once the roots are exposed, if there is adequate room to utilize a mini-excavator without damaging the roots, the mini-excavator can be utilized to complete the excavation down to the water line. 1" plywood shall be placed on grade to provide root protection in the area of access of the mini-excavator. If roots 1" diameter or larger are cut or damaged, responsible party will be subject to a citation under the Street Tree Ordinance, and may also be required to incur the cost of tree removal and replacement of damaged tree on an inch for inch basis, if required by City of Houston Urban Forestry Division.
2. Trees called out for Hand dig short side or long side service lead are located in very close proximity to existing water meters. Excavating the service lead with machinery would significantly impact the tree and be in violation of the City of Houston's Street Tree Ordinance. Short side leads shall be excavated with manual labor to expose any roots 1" in diameter and larger from the service tap of the meter. Come out hole and excavation required for long service leads shall be excavated with manual labor to expose roots 1" in diameter and larger, from the come out hole to the meter. In each case, all roots 1" in diameter and larger shall remain undamaged, the roots shall not be cut, nor shall the bark and cambium layer be scraped or damaged. If roots 1" diameter or larger are cut or damaged, responsible party will be subject to a citation under the cost of tree removal and replacement of damaged tree on an inch by inch basis, if required by City of Houston Urban Forestry Division.
3. Trees called out for Hand dig sanitary stub up are located in very close proximity to proposed service lead. Excavating the service lead with machinery would significantly impact the tree and be in violation of the City of Houston's Street Tree

Ordinance. Excavation for sanitary stub up shall be completed with manual labor to expose any roots 1” in diameter and larger. The lead shall be bored from face of curb to stub up hole when called out in the tree treatment schedule. Come out and stub up holes shall be excavated with manual labor to expose roots 1” in diameter and larger. In case, all roots 1” in diameter and larger shall remain undamaged, the roots shall not be cut, nor shall the bark and cambium layer be scraped or damaged. If roots 1” diameter or larger are cut or damaged, responsible party will be subject to a citation under the Street Tree Ordinance, and may be required to incur the cost of tree removal and replacement of damaged tree on an inch by inch basis, if required by City of Houston Urban Forestry Division.

4. Long side service taps shall not be located in an area specified to be bored in the tree treatment schedule. Should it be absolutely necessary to locate a long side service tap in an area specified to be bored, the excavation shall be completed as specified in paragraph 1 of this section-Hand digging short side service taps.
5. All water meters and sanitary service leads called out on P&P drawings and visible in the field have been addressed in the Tree Protection Plan. Should any additional meters or lead be found during construction, or in any new meters or leads installed beneath the canopy of any tree, fenced for tree protection, the excavation shall be completed as specified in paragraph 1 and/or 2 of this section and paid for at the unit cost for each included in contract.

I. Pruning of Trees

1. Trees shall be pruned in accordance with the American National Standard for tree pruning, ANSI A300 (Part 1) – 2001 Pruning Revision of ANSI A300-1995 Tree, Shrub and Other Woody Plant Maintenance – Standard Practices. Pruning shall be completed by professional arborists who has received training in proper pruning techniques.
2. Clearance prune designated trees for public streets, sidewalks, and construction areas. Provide minimum 14 feet and maximum of 18 feet of vertical clearance over proposed water trunk lines. Provide minimum of 14 feet and maximum of 16 feet of vertical clearance over proposed street construction, from 24” back of curb on one side to 24” back of curb on the other side. Provide 20’ of vertical clearance over proposed storm sewer up to 38” in size, and 30’ of vertical clearance for storm sewer larger than 38” in size. Pruning to be installed prior to any construction activity. Contractor shall notify property owner prior to trimming or pruning any trees with trunks located on private property. Exceptions will be made for trees determined to be arboriculturally significant by City of Houston Urban Forestry. Pruning of trees identified will be completed with approval and supervision of City of Houston Urban Forestry.

3. All cuts should be made sufficiently close to the parent limb or trunk without cutting into the branch collar or leaving a protruding stub, so that closure can readily start under normal conditions. All lateral cuts shall be made to a lateral that is least 1/3 the diameter of the parent limb. Clean cuts shall be made at all times.
4. Trees shall be pruned in a manner that will not destroy or alter the natural shape and character of the tree. Apply black latex paint to all fresh wounds on Oak (*Quercus*) species immediately after each cut is made.
5. Crown cleaning prune designated trees shall include selective removal of dead, diseased, and/or broken limbs.

J. Tree Removal

1. Trees scheduled for removal shall be sawed down and debris hauled from the site the same day. The stump shall be ground to 6" below grade and excess grindings shall be hauled from the site the same day, so that a pile of grindings is not left where the stump was ground. Enough grindings should be left so that an open hole does not remain.
2. Only those trees called out for removal in the Tree Treatment Schedule shall be removed, or otherwise damaged. Should it be determined that any additional trees must be removed, a permit must be applied for and approved from the City of Houston Urban Forestry Division prior to removal. Contractor shall contact Urban Forestry at 832-395-8459.

K. Root Stimulation

1. Deep root stimulate designated trees. Mix fertilizer with wetting agent per label instructions.
2. Stimulate entire root zone area within the dripline of the tree and continue 10 feet beyond the dripline, leaving out areas of anticipated root loss (construction areas).
3. Mixture shall be injected into the top 10 inches of soil under pressure of 150 to 200 psi as soil conditions warrant.
4. Mix in a tank with agitation capability per label instructions. Inject the mixture on a 2.5 ft. square grid at 4 lbs, actual nitrogen per 1,000 sq. ft.

- L. Regularly water trees which have received root damage, to eliminate additional stress caused by lack of moisture. Water during periods without adequate rainfall. For example, should 1.0" of rain not be received within a week period, the trees should be thoroughly watered.

March through September, water once every two weeks. October through February, water every three weeks. Water thoroughly to saturate the entire root zone area.

- M. Chemically treat tree trunks with evidence of borer activity with the appropriate approved insecticide mixed and applied per the manufacturer's product application recommendations. Trees shall be sprayed within 24 hours after observance of borer activity.
- N. Grading and filling around trees.
1. Maintain existing grade within the dripline of trees, unless otherwise indicated.
 2. Where existing grade around trees is above new finish grade, under supervision of project urban forester, carefully hand excavate within the dripline to make transition to new finish grade.
 3. Where existing grade is below new finish grade, place clean bank sand in a single layer to make the transition to new grade. Do not compact; hand grade to required elevation. Specifically to areas where proposed curb is higher than existing and backfill will be required.
- O. Demolition, Forming and Pouring Sidewalks (Sidewalk on Grade)
1. Demolition of existing sidewalks, located in or adjacent to the limits of tree protection fencing, shall be completed without disturbing, cutting, or otherwise damaging tree roots and soil located beneath them.
 2. The new sidewalk shall be formed at or above the elevation of the existing sidewalk, without disturbing, cutting or otherwise damaging tree roots. Every effort has been made to address tree root and sidewalk elevation issues with information available in the field and on plan and profile sheets. The elevation of every tree root was not available, if tree roots are found to be in conflict with proposed sidewalk, project engineer and urban forester shall be consulted as to how to install sidewalks with minimal impacts to adjacent trees.
 3. Checkerplate shall be installed in areas called out only if tree root elevations prohibit construction of ADA compliant sloped concrete sidewalks. Checkerplate shall be installed per detail.
- P. Zero curb cutback
1. Disturbance of tree roots or soil behind the existing and/or proposed curb within root zones of trees designated for zero curb cutback shall be prohibited. If the curb can not be removed without disturbing soil or damaging roots back of curb when using

equipment for demolition, the curb shall be broken using a hand held jackhammer and removed by hand.

2. The exposed roots and soil shall be covered immediately after demolition with 6 mil polyethylene in order to avoid desiccation, and contamination by the lime used for road bed stabilization. The polyethylene shall be placed so that it covers the vertical face of soil back of curb and laid back onto the grade 12 inches back of curb. The polyethylene should remain in place, across the entire area specified for zero curb cutback, from the time the existing curb is demolished until the time when the new curb is formed and backfilled. The polyethylene can be pulled up from the vertical face while the road bed is being graded or mixed, to avoid catching the plastic with machinery, but shall be replaced immediately after equipment has completed. The vertical face shall not be exposed for more than 8 hours in any 24 hour period.
3. There shall be no stabilization back of curb in the zero curb cutback areas, or forming with steel forms. The existing grade and roots back of existing curb shall not be disturbed. This may require forming of the new street with wooden forms with stakes inside forms, which may require leaving the forms in place after the street is poured. Should wooden forms be utilized, the wood shall be at minimum a 2x6. The new curb may require hand finishing, as a slip curb machine may not have adequate clearance without disturbing the roots that are to be protected with the zero curb cutback.
4. Roots extending into the street, or on top of the existing curb, in areas to paved shall be cut and removed by hand prior to disturbance or removal with equipment. Roots shall be pruned flush with the proposed back of curb. Roots one inch in diameter and larger shall be cut in a manner to provide a smooth, clean cut surface. Cuts shall be made with the appropriate pruning shears or pruning saws. Roots shall not be chopped or broken.
5. In areas where proposed curb will be may be lower than existing top of curb and tree roots 2" diameter or larger are present, the soil and roots shall not be graded or laid back. The existing elevation shall be maintained and the curb formed to meet elevation or a short elevation difference roots and top of curb maintained.

Q. Demolition, Forming and Pouring of Drive Way Approaches

1. Demolition of existing driveway approaches located beneath the dripline of any tree shall be completed without disturbing, cutting, or otherwise damaging tree roots and soil located beneath them.
2. The new approach shall be formed at or above the elevation of the existing approach where tree roots 2" diameter or larger are present, without disturbing, cutting or

otherwise damaging tree roots. Maximum drive slopes may be needed at bottom of apron to allow forming of drive over tree roots at top of drive. As with sidewalks, the elevation of every tree roots was not available in design. If tree roots are found to be in conflict with proposed approach, project engineer and urban forester shall be consulted as to how to install drive way with minimal impacts to adjacent trees.

R. Replacement Trees for Tree Removals under Ordinance

1. Location, species, and size of replacement trees are indicated on the drawings. Contractor shall layout individual trees at locations shown on drawings. Contractor shall layout individual trees at locations shown on drawings and be responsible for utility locate requirements. In case of conflicts, notify City Engineer and City Urban Forestry before proceeding with work. Trees shall be laid out and locations approved by City Engineer prior to planting.
2. Trees shall meet and be planted according to City of Houston Standard Specification 02915.

S. Arborist and Urban Forester Qualifications

1. Arborist – Employ qualified arborist acceptable to City’s Parks and Recreation Department to complete all tree treatments. Arborist shall be normally engaged in the field and have a minimum of 5 years experience. Qualifications of the selected arborist shall be submitted for review and approval by the project engineer and City of Houston.
2. Urban Forester – An Urban forester shall be hired to monitor and assist with field layout (exact locations of fencing, root pruning, and zero curb cutback) of the tree preservation program during demolition and construction to ensure tree protection procedures and techniques are practiced as specified to address concerns and conditions which occur in the field. At a minimum, the individual responsible for monitoring and field layout of the tree protection shall have a minimum of 5 years of experience as a consultant, and shall not be affiliated with a tree care contractor in the Houston area. Qualifications of the selected urban forester shall be submitted for review and approval by the project engineer and City of Houston Urban Forestry Department.

END OF SECTION

Section 01570

STORM WATER POLLUTION PREVENTION CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Implementation of Storm Water Pollution Prevention Plans (SWP3) described in Section 01410 – TPDES Requirement.
- B. Installation, maintenance and removal, of storm water pollution prevention structures: diversion dikes, interceptor dikes, diversion swales, interceptor swales, down spout extenders, pipe slope drains, paved flumes and level spreaders. Structures are used during construction and prior to final development of the site.
- C. Filter Fabric Barriers:
 - 1. Type 1: Temporary filter fabric barrier for erosion and sediment control in non-channelized flow areas.
 - 2. Type 2: Temporary reinforced filter fabric barrier for erosion and sediment control in channelized flow areas.
- D. Hay Bale Fence.
- E. Drop Inlet Basket
- F. Inlet Sediment Traps
- G. Brush Berm
- H. Sand Bag Barrier
- I. Bagged Gravel Barrier
- J. Sediment Basin
- K. Inlet Protection Barrier

1.02 MEASUREMENT AND PAYMENT

A. UNIT PRICES

- 1. Payment for filter fabric barrier is on a linear foot basis measured between limits of beginning and ending of stakes.

2. Payment for reinforced filter fabric barrier is on a linear foot basis measured between limits of beginning and ending of stakes.
 3. Payment for drop inlet baskets is on a unit price basis for each drop inlet basket.
 4. Payment for storm inlet sediment traps is on a unit price basis for each storm inlet sediment trap.
 5. Payment for storm water pollution prevention structures is on a lump sum basis for the project. Earthen structures with outlet and piping include diversion dikes, interceptor dikes, diversion swales, interceptor swales, and excavated earth-outlet sediment trap, embankment earth-outlet sediment trap, down spout extenders, pipe slope drains, paved flumes, stone outlet sediment trap, and level spreaders.
 6. Payment for hay bale barrier, if included in Document 00410 - Bid Form, is on a linear foot of accepted bale barriers, if not include in cost of storm water pollution prevention structures.
 7. Payment for brush berm, if included in Document 00410 - Bid Form, is on a linear foot of accepted brush berm, if not include in cost of storm water pollution prevention structures.
 8. Payment for sandbag barrier, if included in Document 00410 - Bid Form, is on a linear foot basis measured between limits of beginning and ending of sandbags, if not include in cost of storm water pollution prevention structures.
 9. Payment for bagged gravel barrier, if included in Document 00410 - Bid Form, is on a linear foot basis measured between limits of beginning and ending of bagged gravel barrier, if not include in cost of storm water pollution prevention controls.
 10. Payment for inlet protection barriers, if included in Document 00410 - Bid Form, is on a linear foot basis measured along outside face of inlet protection barrier, if not include in cost of storm water pollution prevention structures.
 11. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum) Contract. If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated

1.03 REFERENCE STANDARDS

A. ASTM

1. A 36 – Standard Specification for Carbon Structural Steel.
2. D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600kN-m/m³)).
3. D3786 – Standard Test Method for Hydraulic Bursting Strength for knitted Goods and Nonwoven Fabrics.
4. D 4355 - Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
5. D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
6. D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
7. D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
8. D 6382 - Standard Practice for Dynamic Mechanical Analysis and Thermogravimetry of Roofing and Waterproofing Membrane Material.

- B. Storm Water Management Handbook for Construction Activities prepared by City of Houston, Harris County and Harris County Flood Control District.

1.04 SYSTEM DESCRIPTIONS

- A. Filter Fabric Barrier Type 1 and Type 2: Install to allow surface or channel runoff percolation through fabric in sheet-flow manner and to retain and accumulate sediment. Maintain Filter Fabric Barriers to remain in proper position and configuration at all times.
- B. Hay Bale Fence: Install to allow surface runoff percolation through hay in sheet-flow manner and to retain and accumulate sediment. Maintain Hay Bale Fence to remain in proper position and configuration at all times.
- C. Interceptor Dikes and Swales: Construct to direct surface or channel runoff around the project area or runoff from project area into sediment traps.
- D. Drop Inlet Baskets: Install to allow runoff percolation through the basket and to retain and accumulate sediment. Clean accumulation of sediment to prevent clogging and backups.

- E. Sediment Traps: Construct to pool surface runoff from construction area to allow sediment to settle onto the bottom of trap.
- F. Sand Bags: Are used during construction activities in unstabilized minor swales, ditches, or streambeds when the contributing drainage area is no greater than 2 acres. It is also sediment barrier for stage one Inlet.
- G. Bagged Gravel Barrier: Are used during construction activities in unstabilized minor swales, ditches, or streambeds when the contributing drainage area is no greater than 2 acres. It is also sediment barrier for stage two Inlet.
- H. Drop Inlet Insert Basket: Is a temporary barrier placed within a storm drain inlet (Lower Portion of Stage I and Upper Portion of Stage II Inlets) consisting of a filter fabric supported by a metal frame work to prevent sediment and other pollutants from entering convey system.
- I. Brush Berm: Brush Berm is constructed at the perimeter of a distribute site within the developing area.

1.05 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit manufacturer's literature for product specifications and installation instructions.
- C. Submit manufacturer-s catalog sheets and other product data on geotextile or filter fabrics, outlet pipe, perforated riser and connectors.
- D. Submit proposed methods, equipment, materials, and sequence of operations for storm-water pollution prevention structures.
- E. Submit shop drawings for Drop Inlet Baskets.

PART 2 P R O D U C T S

2.01 CONCRETE

- A. Concrete: Class B in accordance with Section 03315 – Concrete for Utility Construction or as shown on the Drawings.

2.02 AGREGATE MATERIALS

- A. Use poorly graded cobbles with diameter greater than 3 inches and less than 5 inches.

- B. Provide gravel lining in accordance with Section 2320 – Utility Backfill Materials or as shown on the drawings.
- C. Provide clean cobbles and gravel consisting of crushed concrete or stone. Use clean, hard crushed concrete or stone free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic matter.
- D. Sediment Pump Pit Aggregate: Use nominal 2-inch diameter river gravel.

2.03 PIPE

- A. Polyethylene culvert pipe or PVC sewer pipe in accordance with Section 02505- High Density Polyethylene (HDPE) Solid and Profile Wall Pipe and Section 02506 Polyvinyl Chloride Pipe or as shown on the Drawings.
- B. Inlet Pipes: Galvanized steel pipe in accordance with Section 02642 Corrugated Metal Pipe or as shown on the Drawings.
- C. Standpipe for Sediment Pump Pits: Galvanized round culvert pipe or round PVC pipe, minimum of 12-inch and a maximum of 24-inch diameter, perforate at 6 to 12 inch centers around circumference.

2.04 GEOTEXTILE FILTER FABRIC

- A. Woven or nonwoven geotextile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material, in continuous rolls of longest practical length.
- B. Grab Strength: 100 psi in any principal direction (ASTM D-4632), Mullen burst strength >200 psi (ASTM D-3786), and equivalent opening size between 50 and 140.
- C. Furnish ultraviolet inhibitors and stabilizers for minimum 6 months of expected usable construction life at temperature range of 0 degrees F to 120 degrees F.
- D. Mirafi, Inc., Synthetic Industries, or equivalent

2.05 BARRIER

- A. Wire Barrier: Woven galvanized steel wire, 14 gauge by 6-inch square mesh spacing, minimum 24 inch roll or sheet width of longest practical length.
- B. Barrier Stakes: Nominal 2 by 2 inch moisture-resistant treated wood or steel posts (min. of 1.25 lbs. per linear foot and Brinell Hardness greater than 140) with safety caps on top; length as required for minimum 8 inch bury and full

height of filter fabric.

2.06 SANDBAGS

- A. Provide woven material made of polypropylene, polyethylene, or polyamide material.
1. Minimum unit weight of four ounces per square yard.
 2. Minimum grab strength of 100 lbs in any principal direction (ASTM D4632)
 3. Mullen burst strength exceeding 300 lbs (ASTM D4833).
 4. Ultraviolet stability exceeding 70 percent. After 500 hours of exposure (ASTM 4355).
 5. Size: Length:18 to 24 inches. Width: 12 to 18 inches. Thickness: 6 to 8 inches. Weight: Approximately 40 to 50 pounds not to exceed 75 pounds.

2.07 Bagged gravel Barrier

1. Minimum unit weight of four ounces per square yard.
2. Minimum grab strength of 100 lbs in any principal direction (ASTM D4632)
3. Mullen burst strength exceeding 300 lbs (ASTM D4833).
4. Ultraviolet stability exceeding 70 percent. After 500 hours of exposure (ASTM 4355).
5. Size: Length:18 to 24 inches. Width: 12 to 18 inches. Thickness: 6 to 8 inches. Weight: Approximately 40 to 50 pounds not to exceed 75 pounds.

2.08 DROP INLET BASKET

- A. Provide steel frame members in accordance with ASTM A36.
- B. Construct top frame of basket with two short sides of 2 inch by 2 inch and single long side of 1 inch by 1 inch, 1/8 inch angle iron. Construct basket hangers of 2 inch by 1/4 inch iron bars. Construct bottom frame of 1 inch by 1/4 inch iron bar or 1/4 inch plate with center 3 inches removed. Use minimum 1/4 inch diameter iron rods or equivalent for sides of inlet basket.

Weld minimum of 14 rods in place between top frame/basket hanger and bottom frame. Exact dimensions for top frame and insert basket will be determined based on dimensions of type of inlet being protected.

2.09 HAY BALE

- A. Hay: Standard-baled agricultural hay bound by wire, nylon, or polypropylene rope. Do not use jute or cotton binding.
- B. Hay Bale Stakes (applicable where bales are on soil): No. 3 (3/8 diameter) reinforcing bars, deformed or smooth at Contractor's option, length as required for minimum 18 inch bury and full height bales.

PART 3 EXECUTION

3.01 PREPARATION, INSTALLATION AND MAINTENANCE

- A. Provide erosion and sediment control structures at locations shown on the Drawings.
- B. Do not clear, grub or rough cut until erosion and sediment control systems are in place unless approved by Project Manger to allow installation of erosion and sediment control systems, soil testing and surveying.
- C. Maintain existing erosion and sediment control systems located within project site until acceptance of Project or until directed by Project Manger to remove and discard existing system.
- D. Regularly inspect and repair or replace damaged components of erosion and sediment control structures. Unless otherwise directed, maintain erosion and sediment control structure until project area stabilization is accepted. . Redress and replace granular fill at outlets as needed to replenish depleted granular fill. Remove erosion and sediment control structures promptly when directed by Project Manger. Dispose of materials in accordance with Section 01576 - Waste Material Disposal.
- E. Remove and dispose sediment deposits at the designated spoil site for the Project. If a project spoil site is not designated on Drawings, dispose of sediment off site at approved location in accordance with Section 01576 - Waste Material Disposal.
- F. Unless otherwise shown on the Drawings, compact embankments, excavations, and trenches in accordance with Section 02315 Roadway

Excavation or Section 2317 Excavation and Backfill for Utilities.

- G. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated right of way and easements for construction. Immediately repair damage caused by construction traffic to erosion and sediment control structures.
- H. Protect existing trees and plants in accordance with Section 1562 – Tree and Plant Protection.

3.02 SEDIMENT TRAPS

- A. Install sediment traps so that surface runoff shall percolate through system in sheet flow fashion and allow retention and accumulation of sediment.
- B. Inspect sediment traps after each rainfall, daily during periods of prolonged rainfall, and at a minimum once each week. Repair or replace damaged sections immediately.
- C. Use fill material for embankment in accordance with Section 02320 – Utility Backfill Materials.
- D. Excavation length and height shall be as specified on Drawings. Use side slopes of 2:1 or flatter.
- E. Stone outlet sediment traps:
 - 1. Maintain minimum of 6 inches between top of core material and top of stone outlet, minimum of 4 inches between bottom of core material and existing ground and minimum of 1 foot between top of stone outlet and top of embankment.
 - 2. Embed cobbles minimum of 4 inches into existing ground for stone outlet. Core shall be minimum of 1 foot in height and in width and wrapped in triple layer of geotextile filter fabric.
- F. Sediment Basin with Pipe Outlet Construction Methods: Install outlet pipe and riser as shown on the Drawings.
- G. Remove sediment deposits when design basin volume is reduced by one-third or sediment level is one foot below principal spillway crest, whichever is less.

3.03 FILTER FABRIC BARRIER CONSTRUCTION METHODS

- A. Fence Type 1: Filter Fabric: Barrier

1. Install stakes 3 feet on center maximum and firmly embed minimum 8 inches in soil. If filter fabric is factory preassembled with support netting, then maximum support spacing is 8 feet. Install wood stakes at a slight angle toward the source of anticipated runoff.
2. Trench in the toe of the fence lines so the downward face of the trenches is flat and perpendicular to direction of flow. V-trench configuration as shown on Drawings may also be used.
3. Lay fabric along edges of trenches in longest practical continuous runs to minimize joints. Make joints only at a support post. Splice with minimum 6-inch overlap and seal securely.
4. Staple filter fabric to stakes at maximum 3 inches on center. Extend fabric minimum 18 inches and maximum 36 inches above natural ground.
5. Backfill and compact trench.

B. Barrier Type 2: Reinforced Filter Fabric Barrier

1. Layout barrier same as for Type 1.
2. Install stakes at 6 feet on center maximum and at each joint in wire fence, firmly embedded 1-foot minimum, and inclined it as for Type 1.
3. Tie wire fence to stakes with wire at 6 inches on center maximum. Overlap joints minimum one bay of mesh.
4. Install trench same as for Type 1.
5. Fasten filter fabric wire fence with tie wires at 3 inches on center maximum.
6. Layout fabric same as for Type 1. Fasten to wire fence with wire ties at 3 inches on center maximum and, if applicable, to stakes above top of wire fence it as for Type 1.
7. Backfill and compact trench.
8. Attach filter fabric to wooden fence stakes spaced a maximum of 6 feet apart or steel fence stakes spaced a maximum of 8 feet apart and embedded a minimum of 12 inches. Install stakes at a slight angle toward source of anticipated runoff.
9. Trench in toe of filter fabric barrier with spade or mechanical trencher so that downward face of trench is flat and perpendicular to direction of flow. A V-trench configuration may also be used. Lay filter fabric along edges of trench. Backfill and compact trench upon completion of Construction.

10. Filter fabric fence shall have a minimum height of 18 inches and a maximum height of 36 inches above natural ground.
11. Cut length of fence to minimize use of joints. When joints are necessary, splice fabric together only at support post with minimum 6 inch overlap and seal securely.
12. When used in swales, ditches or diversions, elevation of barrier at top of filter fabric at flow line location in channel shall be lower than bottom elevation of filter fabric at ends of barrier or top of bank, whichever is less, in order to keep storm water discharge in channel from overtopping bank.

C. Triangular Filter Fabric Barrier Construction Methods

1. Attach filter fabric to wire fencing, 18 inches on each side. Provide a fabric cover and skirt with continuous wrapping of fabric. Skirt should form continuous extension of fabric on upstream side of fence.
2. Secure triangular fabric filter barrier in place using one of the following methods:
 - a. Toe-in skirt 6 inches with mechanically compacted material;
 - b. Weight down skirt with continuous layer of 3-inch to 5-inch graded rock; or
 - c. Trench-in entire structure 4 inches.
3. Anchor triangular fabric filter barrier structure and skirt securely in place using 6-inch wire staples on 2-foot centers on both edges and on skirt, or staked using 18-inch by 3/8-inch diameter re-bar with tee ends.
4. Lap fabric filter material by 6 inches to cover segment joints. Fasten joints with galvanized shoat rings.

3.04 DIKE AND SWALE

- A. Unless otherwise indicated, maintain minimum dike height of 18 inches, measured from cleared ground at up slope toe to top of dike. Maintain side slopes of 2:1 or flatter.
- B. Dike and Swale Stabilization: When shown on the Drawings, place gravel lining 3 inches thick and compacted into the soil or 6 inches thick if truck crossing is expected. Extend gravel lining across bottom and up both sides of swale minimum height of 8 inches vertically, above bottom. Gravel lining on dike side shall extend up the up slope side of dike a minimum height of 8 inches, measured vertically from interface of existing or graded ground and up slope toe of dike, as shown on Drawings.

- C. Divert flow from dikes and swales to sediment basins, stabilized outlets, or sediment trapping devices of types and at locations shown on Drawings. Grade dikes and swales as shown on Drawings, or, if not specified, provide positive drainage with maximum grade of 1 percent to outlet or basin.
- D. Clear in accordance with Section 2233 – Clearing and Grubbing Compact embankments in accordance with Section 2315 – Roadway Excavation.
- E. Carry out excavation for swale construction so that erosion and water pollution is minimal. Minimum depth shall be 1 foot and bottom width shall be 4 feet, with level swale bottom. Excavation slopes shall be 2:1 or flatter. Clear, grub and strip excavation area of vegetation and root material.

3.05 DOWN SPOUT EXTENDER

- A. Down spout extender shall have slope of approximately 1 percent. Use pipe diameter of 4 inches or as shown on the Drawings. Place pipe in accordance with Section 2317 - Bedding and Backfill for Utilities.

3.06 PIPE SLOPE DRAIN

- A. Compact soil around and under drain entrance section to top of embankment in lifts appropriately sized for method of compaction utilized.
- B. Inlet pipe shall have slope of 1 percent or greater. Use pipe diameter as shown on the Drawings.
- C. Top of embankment over inlet pipe and embankments directing water to pipe shall be at least 1 foot higher at all points than top of inlet pipe.
- D. Pipe shall be secured with hold-down grommets spaced 10 feet on centers.
- E. Place riprap apron with a depth equal to pipe diameter with 2:1 side slopes.

3.07 PAVED FLUME

- A. Compact soil around and under the entrance section to top of the embankment in lifts appropriately sized for method of compaction utilized.
- B. Construct subgrade to required elevations. Remove and replace soft sections and unsuitable material. Compact subgrade thoroughly and shape to a smooth, uniform surface.
- C. Construct permanent paved flumes in accordance with Drawings.

- D. Remove sediment from riprap apron when sediment has accumulated to depth of one foot.

3.08 LEVEL SPREADER

- A. Construct level spreader on undisturbed soil and not on fill. Ensure that spreader lip is level for uniform spreading of storm runoff.
- B. Maintain at required depth, grade, and cross section as specified on Drawings. Remove sediment deposits as well as projections or other irregularities which will impede normal flow.

3.09 INLET PROTECTION BARRIER

- A. Place sandbags for Stage I, Bagged gravel for Stage II and filter fabric barriers at locations shown on the SWP3. Maintain to allow minimal inlet in flow restrictions / blockage during storm event.

3.10 DROP INLET BASKET CONSTRUCTION METHODS

- A. Fit inlet insert basket into inlet without gaps around insert at locations shown on the SWP3.
- B. Support for inlet insert basket shall consist of fabricated metal as shown on Drawings.
- C. Push down and form filter fabric to shape of basket. Use sheet of fabric large enough to be supported by basket frame when holding sediment and extend at least 6 inches past frame. Place inlet grates over basket/frame to serve as fabric anchor.
- D. Remove sediment deposit after each storm event and whenever accumulation exceeds 1-inch depth during weekly inspections.

3.11 HAY BALE FENCE CONSTRUCTION METHODS

- A. Place bales in row with ends tightly abutting adjacent bales. Place bales with bindings parallel to ground surface.
- B. Embed bale in soil a minimum of 4 inches.
- C. Securely anchor bales in place with Hay Bale Stakes driven through bales a minimum of 18-inches into ground. Angle first stake in each bale toward previously laid bale to force bales together.
- D. Fill gaps between bales with straw to prevent water from channeling between bales. Wedge carefully in order not to separate bales.

- E. Replace with new hay bale fence every two months or as required by Project Manager.

3.12 BRUSH BERM CONSTRUCTION METHODS

- A. Construct brush berm along contour lines by hand placing method. Do not use machine placement of brush berm.
- B. Use woody brush and branches having diameter less than 2-inches with 6-inches overlap. Avoid incorporation of annual weeds and soil into brush berm.
- C. Use minimum height of 18-inches measured from top of existing ground at upslope toe to top of berm. Top width shall be 24 inches minimum and side slopes shall be 2:1 or flatter.
- D. Embed brush berm into soil a minimum of 4-inches and anchor using wire, nylon or polypropylene rope across berm with a minimum tension of 50 pounds. Tie rope securely to 18-inch x 3/8-inch diameter rebar stakes driven into ground on 4-foot centers on both sides of berm.

3.13 STREET AND SIDEWALK CLEANING

- A. Keep areas clean of construction debris and mud carried by construction vehicles and equipment. If necessary, install stabilized construction exits at construction, staging, storage, and disposal areas, following Section 01575-Stabilized Construction Exit.
- B. In lieu of or in addition to stabilized construction exits, shovel or sweep pavements as required to keep areas clean. Do not waterhose or sweep debris and mud off street into adjacent areas, except, hose sidewalks during off-peak hours, after sweeping.

3.14 WASTE COLLECTION AREAS

- A. Prevent water runoff from passing through waste collection areas, and prevent water runoff from waste collection areas migrating outside collection areas.

3.15 EQUIPMENT MAINTENANCE AND REPAIR

- A. Confine maintenance and repair of construction machinery and equipment to areas specifically designated for that purpose, so fuels, lubricants, solvents, and other potential pollutants are not washed directly into receiving streams or storm water conveyance systems. Provide these areas with adequate waste disposal receptacles for liquid and solid waste. Clean and inspect maintenance areas daily.

- B. Where designated equipment maintenance areas are not feasible, take precautions during each individual repair or maintenance operation to prevent potential pollutants from washing into streams or conveyance systems. Provide temporary waste disposal receptacles.

3.16 VEHICLE/ EQUIPMENT WASHING AREAS

- A. Install wash area (stabilized with coarse aggregate) adjacent to stabilized construction access, as required to prevent mud and dirt run-off. Release wash water into drainage swales or inlets protected by erosion and sediment controls. Build wash areas following Section 01575- Stabilized Construction access. Install gravel or rock base beneath wash areas.
- B. Wash vehicles only at designated wash areas. Do not wash vehicles such as concrete delivery trucks or dump trucks and other construction equipment at locations where runoff flows directly into waterways or storm water conveyance systems.
- C. Locate wash areas to spread out and evaporate or infiltrate wash water directly into ground, or collect runoff in temporary holding or seepage basins.

3.17 WATER RUNOFF AND EROSION CONTROL

- A. Control surface water, runoff, subsurface water, and water from excavations and structures to prevent damage to the Work, the site, or adjoining properties. Follow environment requirements.
- B. 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 to prevent erosion, sedimentation or damage.
- C. Provide, operate, and maintain equipment and facilities of adequate size to control surface water.
- D. Retain existing drainage patterns external to the site by constructing temporary earth berms, sedimentation basins, retaining areas, and temporary ground cover as required to control conditions.
- E. Plan and execute construction and earth work to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
 - 1. Hold area of bare soil exposed at one time to a minimum.
 - 2. Provide temporary controls such as berms, dikes, and drains.
- F. Construct fill and waste areas by selective placement to eliminate surface silts or clays which will erode.

- G. Inspect earthwork periodically to detect start of erosion. Immediately apply corrective measures as required to control erosion.
- H. Dispose of sediments offsite, not in or adjacent to waterways or floodplains, nor allow sediments to flush into streams or drainage ways. Assume responsibility for offsite disposal location.
- I. Unless otherwise indicated, compact embankments, excavations, and trenches by mechanically blading, tamping, and rolling soil in maximum of 8-inch layers. Provide compaction density at minimum 90 percent Standard Proctor ASTM D-698-78 density. Make at least one test per 500 cubic yards of embankment.
- J. Prohibit equipment and vehicles from maneuver on areas outside of dedicated rights-of-way and easements for construction. Immediately repair damage to erosion and sedimentation control systems caused by construction traffic.
- K. Do not damage existing trees intended to remain.

3.18 REMOVAL OF CONTROLS

- A. Remove erosion and sediment controls when the site is finally stabilized or as directed by Project Manager.
- B. Dispose of sediments and waste products following Section 01505-Temporary Facilities.

END OF SECTION

Section 01575

STABILIZED CONSTRUCTION ACCESS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Installation and removal of erosion and sediment control for stabilized construction access used during construction and prior to final development of site, as shown in City of Houston Standard Construction details, DWG No. 01571-01.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Price Contracts. If Contract is Unit Price Contract, payment for work in this Section will be based on the following:
 - 1. Stabilized construction roads, parking areas, access and wash areas: per square yard of aggregate/recycled concrete without reinforcing placed in 8-inch layers. No separate payment will be made for street cleaning necessary to meet TPDES requirements. Include cost of work for street cleaning under related Specification section.
- B. Stipulated Price (Lump Sum) Contracts. If the Contract is a Stipulated Price Contract, include payment for work under this Section in the total Stipulated Price.

1.03 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit manufacturer-s catalog sheets and other Product Data on geotextile fabric.
- C. Submit sieve analysis of aggregates conforming to requirements of this Specification.

1.04 REFERENCES

- A. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- B. Storm Water Quality Management Handbook For Construction Activities prepared by the City of Houston, Harris County and Harris County Flood Control District.

PART 2 PRODUCTS**2.01 GEOTEXTILE FABRIC**

- A. Provide woven or non-woven geotextile fabric made of polypropylene, polyethylene, ethylene, or polyamide material.
- B. Geotextile fabric: Minimum grab strength of 200 lbs in any principal direction (ASTM D-4632) and equivalent opening size between 50 and 140.
- C. Geotextile and threads: Resistant to chemical attack, mildew, and rot and contain ultraviolet ray inhibitors and stabilizers to provide minimum of six months of expected usable life at temperature range of 0 to 120 degrees F.
- D. Representative Manufacturers: Mirafi, Inc. or equal.

2.02 COARSE AGGREGATES

- A. Coarse aggregate: Crushed stone, gravel, crushed blast furnace slag, or combination of these materials. Aggregate shall be composed of clean, hard, durable materials free from adherent coatings of, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.
- B. Coarse aggregates to consist of open graded rock 2" to 8" in size.

PART 3 EXECUTION**3.01 PREPARATION AND INSTALLATION**

- A. Provide stabilized construction roads and access at construction, staging, parking, storage, and disposal areas to keep street clean of mud carried by construction vehicles and equipment. Construct erosion and sediment controls in accordance with Drawings and Specification requirements.
- B. Do not clear grub or rough cut until erosion and sediment control systems are in place, unless approved by Project Manager to allow soil testing and surveying.
- C. Maintain existing construction site erosion and sediment control systems until acceptance of the Work or until removal of existing systems is approved by Project Manager.
- D. Regularly inspect, repair or replace components of stabilized construction access. Unless otherwise directed, maintain stabilized construction roads and

access until the City accepts the Work. Remove stabilized construction roads and access promptly when directed by Project Manager. Discard removed materials off-site.

- E. Remove and dispose of sediment deposits at designated spoil site for Project. If a spoil site is not designated on Drawings, dispose of sediment off-site at a location not in or adjacent to stream or flood plain. Assume responsibility for off-site disposal.
- F. Spread compacted and stabilized sediment evenly throughout site. Do not allow sediment to flush into streams or drainage ways. Dispose of contaminated sediment in accordance with existing federal, state, and local rules and regulations.
- G. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Immediately repair damage to erosion and sediment control systems caused by construction traffic.
- H. Conduct construction operations in conformance with erosion control requirements of Specification 01570 – Storm Water Pollution Control.

3.02 CONSTRUCTION MAINTENANCE

- A. Provide stabilized access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes where shown on Drawings.
- B. Provide stabilized construction access and vehicle washing areas, when approved by Project Manager, of sizes and at locations shown on Drawings or as specified in this Section.
- C. Clean tires to remove sediment on vehicles leaving construction areas prior to entering public right-of-ways. Construct wash areas needed to remove sediment. Release wash water into drainage swales or inlets protected by erosion and sediment control measures.
- D. Details for stabilized construction access are shown on Drawings. Construct other stabilized areas to same requirements. Maintain minimum roadway widths of 14 feet for one-way traffic and 20 feet for two-way traffic and of sufficient width to allow ingress and egress. Place geotextile fabric as a permeable separator to prevent mixing of coarse aggregate with underlying soil. Limit exposure of geotextile fabric to elements between laydown and cover to a maximum 14 days to minimize potential damage.
- E. Grade roads and parking areas to provide sufficient drainage away from stabilized areas. Use sandbags, gravel, boards, or similar materials to prevent sediment from entering public right-of-ways, waterways or

- storm water conveyance systems.
- F. Inspect and maintain stabilized areas daily. Provide periodic top dressing with additional coarse aggregates to maintain required depth. Repair and clean out damaged control systems used to trap sediment. Immediately remove spilled, dropped, washed, or tracked sediment from public right-of-ways.
 - G. Maintain lengths of stabilized areas as shown on Drawings or a minimum of 50 feet. Maintain a minimum thickness of 8 inches. Maintain minimum widths at all points of ingress or egress.
 - H. Stabilize other areas with the same thickness, and width of coarse aggregate required for stabilized construction access, except where shown otherwise on Drawings.
 - I. Stabilized areas may be widened or lengthened to accommodate truck washing areas when authorized by Project Manager.
 - J. Clean street daily before end of workday. When excess sediments have tracked onto streets, Project Manager may direct Contractor to clean street as often as necessary. Remove and legally dispose of sediments.
 - K. Use other erosion and sediment control measures to prevent sediment runoff during rain periods and non-working hours and when storm discharges are expected.

END OF SECTION

Section 01576

WASTE MATERIAL DISPOSAL

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Disposal of waste material and salvageable material.

1.02 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit copy of approved "Development Permit", as defined in Chapter 19 of Flood Plain Ordinance (City Ordinance Number 81-914 and Number 85-1705), prior to disposal of excess material in areas designated as being in "100-year Flood Hazard Area" within the City. Contact the City of Houston Flood Plain Manager, 3300 Main Street, at (713) 525-7605 for flood plain information.
- C. Obtain and submit disposal permits for proposed disposal sites, if required by local ordinances.
- D. Submit copy of written permission from property owner, with description of property, prior to disposal of excess material adjacent to Project. Submit written and signed release from property owner upon completion of disposal work.
- E. Describe waste materials expected to be stored on-site and a description of controls to reduce Pollutants from these materials, including storage practices to minimize exposure of materials to storm water; and spill prevention and response measures in the Project's Storm Water Pollution Prevention Plan (SWPPP). Refer to Section 01410 – TPDES Requirements.

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 SALVAGEABLE MATERIAL

- A. Excavated Material: When indicated on Drawings, load, haul, and deposit excavated material at location or locations shown on Drawings outside limits of Project.

- B. Base, Surface, and Bedding Material: Load shell, gravel, bituminous, or other base and surfacing material designated for salvage into City trucks.
- C. Pipe Culvert: Load culverts designated for salvage into City trucks.
- D. Other Salvageable Materials: Conform to requirements of individual Specification Sections.
- E. Coordinate loading of salvageable material on City trucks with Project Manager.

3.02 EXCESS MATERIAL

- A. Remove and legally dispose of vegetation, rubble, broken concrete, debris, asphaltic concrete pavement, excess soil, and other materials not designated for salvage from job site.
- B. Excess soil may be deposited on private property adjacent to Project when written permission is obtained from property owner. See Paragraph 1.02 D above.
- C. Verify flood plain status of any proposed disposal site. Do not dispose of excavated materials in area designated as within 100-year Flood Hazard Area unless "Development Permit" has been obtained. Remove excess material placed in "100-year Flood Hazard Area" within the City, without "Development Permit", at no additional cost to the City.
- D. Remove waste materials from site daily, in order to maintain site in neat and orderly condition.

END OF SECTION

Section 01578

CONTROL OF GROUND AND SURFACE WATER

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations and foundation beds in stable condition, and controlling ground water conditions for tunnel excavations.
- B. Protecting work against surface runoff and rising floodwaters.
- C. Trapping suspended sediment in the discharge form the surface and ground water control systems.

1.02 MEASUREMENT AND PAYMENT

A. UNIT PRICES

- 1. When noted, dewatering of trench or excavation during course of project shall be measured per linear foot and paid for at contract unit prices for dewatering, when directed to perform such work by Project Manager. Dewatering must be fully detailed in submittal and submittal must be approved prior to performing dewatering work before payment will be made for dewatering. No payment will be made for work unless directed to perform work by Project Manager.
- 2. Presence of a pump on project does not constitute dewatering for payment under bid item "Ground Water Control for Open Cut Construction."
- 3. Dewatering required during course of project to lower water table for other utility installation less than 24 inches in diameter, construction of structures, removal of standing water, surface drainage seepage, or to protect against rising waters or floods shall be considered incidental to Work unless otherwise noted.
- 4. No separate payment will be made for groundwater control associated with augering, tunnels or casing. Include cost in unit price for augering.
- 5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

- B. Stipulated Price (Lump Sum) Contract. If the Contract is a Stipulated Price Contract, include payment for work under this section in the total Stipulated

Price.

1.03 REFERENCES

- A. ASTM D 698 - Standard Test Methods for Laboratory Compaction of Soils Using Standard Effort (12,400 ft-lbf/ft³ (600kN-m/m³))
- B. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA)
- C. Storm Water Management Handbook for Construction Activities prepared by City of Houston, Harris County and Harris County Flood Control District.

1.04 DEFINITIONS

- A. Ground water control system: system used to dewater and depressurize water-bearing soil layers.
 - 1. Dewatering: lowering the water table and intercepting seepage that would otherwise emerge from slopes or bottoms of excavations, or into tunnels and shafts; and disposing of removed water. 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 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, necessary to prevent failure or heaving of excavation bottom or instability of tunnel excavations.
- B. Excavation drainage: includes keeping excavations free of surface and seepage water.
- C. Surface drainage: includes use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines necessary to protect Work from any source of surface water.
- D. Monitoring facilities for ground water control system: includes piezometers, monitoring wells and flow meters for observing and recording flow rates.

1.05 PERFORMANCE REQUIREMENTS

- A. Conduct subsurface investigations to identify groundwater conditions and to

provide parameters for design, installation, and operation of groundwater control systems. Submit proposed method and spacing of readings for review prior to obtaining water level readings.

- B. Design ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926 and Section 02260 - Trench Safety Systems, to produce following results:
 - 1. Effectively reduce hydrostatic pressure affecting:
 - a. Excavations
 - b. Tunnel excavation, face stability or seepage into tunnels
 - 2. Develop 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 loss of fines, seepage, boils, quick condition, or softening of foundation strata
 - 5. Maintain stability of sides and bottom of excavations
- C. Provide ground water control systems that include single-stage or multiple-stage well point systems, eductor and ejector-type systems, deep wells, or combinations of these equipment types.
- D. Provide drainage of seepage water and surface water, as well as water from other sources entering excavation. Excavation drainage may include placement of drainage materials, crushed stone and filter fabric, together with sump pumping.
- E. Provide ditches, berms, pumps and other methods necessary to divert and drain surface water from excavation and other work areas.
- F. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.
- G. Assume sole responsibility for ground water control systems and for any loss or damage resulting from partial or complete failure of protective measures and settlement or resultant damage caused by 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, adjacent water wells, or potentially contaminated areas. Repair damage caused by ground water control systems or resulting from

failure of system to protect property as required.

- H. Install an adequate number of piezometers installed at proper locations and depths, necessary to provide meaningful observations of conditions affecting excavation, adjacent structures and water wells.
- I. Install environmental monitoring wells at proper locations and depths necessary to provide adequate observations of hydrostatic conditions and possible contaminant transport from contamination sources into work area or ground water control system.

1.06 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittals Procedures.
- B. Submit Ground Water and Surface Water Control Plan for review by Project Manager prior to start of excavation work. Include the following:
 - 1. Results of subsurface investigations and description of extent and characteristics of water bearing layers subject to ground water control
 - 2. Names of equipment Suppliers and installation Subcontractors
 - 3. 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. Description of proposed monitoring facilities 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. 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 means

9. Surface water control and drainage installations
 10. Proposed methods and locations for disposing of removed water
- C. Submit following records upon completion of 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
- D. Submit the following records weekly during control of ground and surface water operations:
1. Records of flow rates and piezometric elevations obtained during monitoring of dewatering and depressurization. Refer to Paragraph 3.02, Requirements for Eductor, Well Points, or Deep Wells.
 2. Maintenance records for ground water control installations, piezometers and monitoring wells

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Comply with requirements of agencies having jurisdiction.
- B. Comply with Texas Commission on Environmental Quality regulations and Texas Water Well Drillers Association for development, drilling, and abandonment of wells used in dewatering system.
- C. Obtain necessary permits from agencies with jurisdiction over use of groundwater and matters affecting well installation, water discharge, and use of existing storm drains and natural water sources. Since review and permitting process may be lengthy, take early action to obtain required approvals.
- D. Monitor ground water discharge for contamination while performing pumping in vicinity of potentially contaminated sites.

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIALS

- A. Select equipment and materials necessary to achieve desired results for dewatering. Selected equipment and materials are subject to review by Project Manager through submittals required in Paragraph 1.06, Submittals.
- B. Use experienced contractors, regularly engaged in ground water control system design, installation, and operation, to furnish and install and operate educators, well points, or deep wells, when needed
- C. Maintain equipment in good repair and operating condition.
- D. Keep sufficient standby equipment and materials available to ensure continuous operation, where required.
- E. Portable Sediment Tank System: Standard 55-gallon steel or plastic drums, free of hazardous material contamination.
 - 1. Shop or field fabricate tanks in series with main inlet pipe, inter-tank pipes and discharge pipes, using quantities sufficient to collect sediments from discharge water.

PART 3 EXECUTION

3.01 GROUND WATER CONTROL

- A. Perform necessary subsurface investigation 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 draw down characteristics. Present results in the Ground Water and Surface Water Control Plan. submittal
- B. Provide labor, material, equipment, techniques and methods to lower, control and handle ground water in manner compatible with construction methods and site conditions. Monitor effectiveness of installed system and its effect on adjacent property.
- C. Install, operate, and maintain ground water control systems in accordance with the Ground Water and Surface Water Control Plan. Notify Project Manager in writing of changes made to accommodate field conditions and changes to Work. Provide revised drawings and calculations with notification.
- D. Provide continuous system operation, including nights, weekends, and holidays. Arrange appropriate backup if electrical power is primary energy source for dewatering system.
- E. Monitor operations to verify systems lower ground water piezometric levels at rate required to maintain dry excavation resulting in stable subgrade for

- subsequent construction operations.
- F. Depressurize zones where hydrostatic pressures in confined water bearing layers exist below excavations to eliminate risk of uplift or other instability of excavation or installed works. Define allowable piezometric elevations in the Ground Water and Surface Water Control Plan.
- G. Removal of 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 design phase investigations and left for Contractor's use, upon completion of testing, as required in accordance with Part 3 of applicable specification.
 3. Remove monitoring wells when directed by Project Manager.
 4. Grout abandoned well and piezometer holes. Fill piping that is not removed with cement-bentonite grout or cement-sand grout.
- H. During backfilling, maintain water level a minimum of 5 feet below prevailing level of backfill. Do not allow the water level to cause 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.
- I. Provide uniform pipe diameter for each pipe drain run constructed for dewatering. Remove pipe drains when no longer required. If pipe removal is impractical, grout connections at 50-foot intervals and fill pipe with cement-bentonite grout or cement-sand grout after removal from service.
- J. The extent of ground water control for structures with permanent perforated underground drainage systems may be reduced, for units designed to withstand hydrostatic uplift pressure. Provide a means to drain affected portions of underground systems, including standby equipment. Maintain drainage systems during construction operations.
- K. Remove systems upon completion of construction or when dewatering and control of surface or ground water is no longer required.
- L. Compact backfill to not less than 95 percent of maximum dry density in accordance with ASTM D 698.
- M. Foundation Slab: Maintain saturation line at least 3 feet below lowest elevations where concrete is to be placed. Drain foundations in areas where

concrete is to be placed before placing reinforcing steel. Keep free from water for 3 days after concrete is placed.

3.02 REQUIREMENTS FOR EDUCTOR, WELL POINTS, OR DEEP WELLS

- A. For aboveground piping in ground water control system, include a 12-inch minimum length of clear, transparent piping between each eductor well or well point and discharge header to allow visual monitoring of discharge from each installation.
- B. Install sufficient piezometers or monitoring wells to show that trench or shaft excavations in water bearing materials are pre-drained 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 selected method of work.
- C. Install piezometers or monitoring wells at least one week in advance of the start of associated excavation.
- D. Dewatering may be omitted for portions of under drains or other excavations, where auger borings and piezometers or monitoring wells show that soil is pre-drained by existing systems and that ground water control plan criteria are satisfied.
- E. Replace installations that produce noticeable amounts of sediments after development.
- F. Provide additional ground water control installations, or change method of control if, ground water control plan does not provide satisfactory results based on performance criteria defined by plan and by specifications. Submit revised plan according to Paragraph 1.06B.

3.03 SEDIMENT TRAPS

- A. Install sediment tank as shown on approved plan.
- B. Inspect daily and clean out tank when one-third of sediment tank is filled with sediment.

3.04 SEDIMENT SUMP PIT

- A. Install sediment sump pits as shown on approved plan.
- B. Construct standpipe by perforating 12 inch to 24-inch diameter corrugated metal or PVC pipe.

- C. Extend standpipe 12 inches to 18 inches above lip of pit.
- D. Convey discharge of water pumped from standpipe to sediment trapping device.
- E. Fill sites of sump pits, compact to density of surrounding soil and stabilize surface when construction is complete.

3.05 EXCAVATION DRAINAGE

- A. Use excavation drainage methods if well-drained conditions can be achieved. Excavation drainage may consist of layers of crushed stone and filter fabric, and sump pumping, in combination with sufficient ground water control wells to maintain stable excavation and backfill conditions.

3.06 MAINTENANCE AND OBSERVATION

- A. Conduct daily maintenance and observation of piezometers or monitoring wells while ground water control installations or excavation drainage is operating at the site, or water is seeping into tunnels, and maintain systems in good operating condition.
- B. Replace damaged and destroyed piezometers or monitoring wells with new piezometers or wells as necessary to meet observation schedules.
- C. 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 specified observations
- D. Remove and grout piezometers inside or outside of excavation area when ground water control operations are complete. Remove and grout monitoring wells when directed by Project Manager.

3.07 MONITORING AND RECORDING

- A. 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. Record observations daily until steady conditions are achieved and twice weekly thereafter.
- B. Observe and record elevation of water level daily as long as ground water control system is in operation, and weekly thereafter until Work is completed or piezometers or wells are removed, except when Project Manager determines more frequent monitoring and recording are required. Comply with Project Manager's direction for increased monitoring and recording and

take measures necessary to ensure effective dewatering for intended purpose.

3.08 SURFACE WATER CONTROL

- A. Intercept surface water and divert it away from excavations through use of dikes, ditches, curb walls, pipes, sumps or other approved means. Requirement includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.
- B. 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 agencies.

END OF SECTION

Section 01580

PROJECT IDENTIFICATION SIGNS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project identification sign description.
- B. Project sign installation.
- C. Maintenance and removal of Project sign.

1.02 SYSTEM DESCRIPTION

- A. Sign Construction: Construct signs of new materials in accordance with Standard Detail provided at the Pre-construction Conference.
- B. Appearance: Maintain signs to present a clean and neat look throughout contract duration.
- C. Sign Manufacturer: Experienced professional sign company.
- D. Sign Placement: At locations shown in Drawings unless otherwise specified by Project Manager at pre-construction meeting.
 - 1. Provide one sign at each end of a linear Project involving paving, overlay, sewer line, storm drainage, or water main construction located in rights-of-ways.
 - 2. Provide one sign for site or building construction Contracts
 - 3. Provide one sign at each site for Contracts with multiple sites.
 - 4. Sign Relocation: As work progresses, relocate signs if directed by Project Manager in writing. Include cost for one relocation of post-mounted signs in Contract Price. Subsequent relocations, if directed by Project Manager in writing, will be subject to Change Order.
- E. Skid-mounted signs: Use for projects with noncontiguous locations where work progresses from one location to another. Design skid structure to withstand a 60 mile-per-hour wind load to the face or back of sign using stakes, straps, or ballast. Contractor shall be responsible for security of signs at each site.

PROJECT IDENTIFICATION SIGNS **STANDARD GENERAL REQUIREMENT**

1.03 SUBMITTALS

- A. Submit Shop Drawings under provisions of Section 01330 - Submittal procedures.
- B. Show content, layout, lettering style, lettering size, and colors. Make sign and lettering to scale, clearly indicating condensed lettering, if used.

PART 2 P R O D U C T S

2.01 SIGN MATERIALS

- A. Structure and Framing: Use new sign materials.
 - 1. Sign Posts: 4-inch by 4-inch pressure treated wood posts, 9 feet long for skid mounting and 12 feet long minimum for in-ground mounting.
 - 2. Skid Bracing: 2-inch by 4-inch wood framing material.
 - 3. Skid Members: 2-inch by 6-inch wood framing material.
 - 4. Fasteners:
 - a. Galvanized steel.
 - b. Attach sign to posts with 1/2-inch by 5-1/2 inch button head carriage bolts and secure with nuts and flat head washers.
 - c. Cover button heads with white reflective film or paint to match sign background.
 - d. Use metal brackets and braces and 3/4-inch wood screws to attach sign header.
- B. Sign and Sign Header: 3/4-inch thick marine plywood. Use 4-foot by 8 -foot sheet for the sign and a single piece for the header to minimize joints. Do not piece wood sheets to fabricate sign face.
- C. Paint and Primers: White industrial grade, fast-drying, oil-based paint with gloss finish for structural and framing members, sign, and sign header material surfaces. Paint all sign surfaces prior to adding adhesive applications.
- D. Colors:
 - 1. Sign Background: Reflective white 3M Scotchlite Engineer Grade, Pressure Sensitive Sheeting (White), or approved equal.

2. Border: For red border around area, which designates project name and project amount, use reflective red 3M Scotchlite Engineer Grade, Pressure Sensitive Sheeting (Red), or approved equal.
3. Sign Film: 3M Scotchcal Pressure Sensitive Films, or approved equal for legends, symbols, lettering, and artwork. Match colors to 3M Scotchcal Pressure Sensitive Films.
 - a. Lettering Below Seal: Black
 - b. Lettering Above Project Name: Vivid Blue
 - c. Lettering on Blue Background: White
 - d. Background Behind Project Name: Vivid Blue

E. City Seal: Project Manager will provide City seals to Contractor, as needed.

2.02 SIGN LAYOUT

A. Lettering:

1. Style, Size, and Spacing: Helvetica Regular lettering.
2. Condensed Style: Text may be condensed if needed to maintain sign composition.

B. Composition:

1. Lines with Standard Text
 - a. Top line shall read "BUILDING TOGETHER FOR THE FUTURE".
 - b. Use lower left below City Seal to list names and titles for Mayor, Controller and Council Members. Place as shown on Drawings with indicated size and spacing.
 - c. Center telephone number of the Customer Response Center, "311", near the bottom of the area with the blue background.
2. Lines with Variable Text. Use blue background space for Project name and dollar amount.
 - a. Project Manager will provide Project name and dollar amount of Project for preparation of sign. Center name on one or two lines, and dollar amount immediately below Project name, in area with blue background. Use condensed lettering if necessary.

PROJECT IDENTIFICATION SIGNS **STANDARD GENERAL REQUIREMENT**

2.03 LAYOUT AND COMPOSITION FOR HEADER

- A. City of Houston Seal:
1. A space of approximately 24 inches in diameter is provided for the City seal, the top 6 inches of which extends above the sign on the sign header.
 2. Construct sign header of same material as sign face. Cut material to match curve of the City seal.
 3. Project Manager will provide the seal to be affixed to the sign by sign maker.

PART 3 E X E C U T I O N

3.01 INSTALLATION

- A. Install Project identification signs within seven days after Date of Commencement of the Work.
- B. Erect signs at locations shown in Drawings unless otherwise designated by Project Manager at pre-construction meeting. Position sign so it is fully visible and readable to general public.
- C. Erect sign level and plumb.
- D. If mounted on posts, sink posts 3 to 4 feet below grade and stabilize posts to minimize lateral motion. Leave a minimum of 8 feet of post above existing grade for mounting of sign.
- E. Erect sign so that top edge of sign is at a nominal 8 feet above existing grade.

3.02 MAINTENANCE AND REMOVAL

- A. Keep signs and supports clean. Repair deterioration and damage.
- B. Remove signs, framing, supports, and foundations to a depth of at least 2 feet upon completion of Project. Restore area to a condition equal to or better than before construction.

PROJECT No.: (FILE NO:)	CONTRACT No.:	REVIEWED BY:
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*INSTRUCTIONS TO SIGN MAKER (LIST COMPANY NAME):	
QTY.	ACTION ITEMS:
	Make new sign(s)
	Follow City standards attached
	Provide submittal (drawing) to the City for project sign showing content, layout, lettering style, lettering size, and colors
VARIABLE TEXT	
Line 1	Project Name:
Line 2	Project Amount (rounded to nearest \$1000):
ATTACHMENTS INCLUDED	
QTY.	SEALS / LOGOS
	City of Houston - 24" diameter
	STANDARDS
	Standard Specification Section 01580 - Project Identification Signs
	Standard Detail 01580-03 Construction Sign

(Instructions on reverse.)

PROJECT IDENTIFICATION SIGNS **STANDARD GENERAL REQUIREMENT****INSTRUCTIONS**

Contractor produces this form. Contractor shall insert the information and provide the form to the sign maker with Contractor's purchase order.

List PROJECT No., (FILE No.), CONTRACT No., and name of City's Project Manager REVIEWED BY.

INSTRUCTIONS TO SIGN MAKER:

- Give COMPANY NAME of sign maker.
- Indicate QUANTITY of new signs to be made.
- Direction for sign maker to follow City Standards in making signs.
- Require submittals from sign maker, who provides Shop Drawing of Project sign showing content, layout, lettering style, lettering size, and colors.

VARIABLE TEXT:

- Give PROJECT NAME. Write it out in all caps and suggest line break. Lines are required.
- Give Project amount to be listed on sign. Round off to nearest \$1000.

ATTACHMENTS INCLUDED:

- **Seals**

City provides the quantity of City seals required one for each Project sign.

- **Standards**

Contractor provides set of Standards to sign maker, including (Specification Section 01580 - Project Identification Signs, and Standard Detail No. 01580-03 - Construction Sign.

Section 01581

EXCAVATION IN PUBLIC WAY PERMIT SIGNS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Project sign installation.
- B. Maintenance and removal of Project sign.

1.02 SYSTEM DESCRIPTION

- A. Sign Construction: Construct signs of new materials.
- B. Appearance: Maintain signs to present a clean and neat look throughout the Contract duration.
- C. Sign Placement: Place signs at each street entrance to street cut excavation.

1.03 SUBMITTALS

- A. Submit Shop Drawings under provisions of Section 01330 - Submittal Procedures.
- B. Show content, layout, lettering style, lettering size and colors. Make sign and lettering to scale, clearly indicating condensed lettering, if used.

PART 2 P R O D U C T S

2.01 SIGN LAYOUT

- A. Conform to Texas Manual on Uniform Traffic Control Devices. Minimum size: 36 inches by 36 inches.
- B. Lettering: Uppercase Helvetica Regular lettering.
- C. Composition: Include on sign copy of street cut permit, title "City of Houston", contracting department's name, address, and emergency telephone number and Contractor's name. Project Manager will provide department name, address, and emergency telephone number for preparation of sign.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install Project signs before commencement of pavement excavation in Public Way.
- B. Position sign so it is fully visible and readable to general public.
- C. Erect sign level and plumb.
- D. Erect sign so that top edge of sign is at a nominal 8 feet above existing grade.

3.02 MAINTENANCE AND REMOVAL

- A. Keep signs and supports clean. Repair deterioration and damage.
- B. Remove signs, framing, supports and foundations to depth of at least 2 feet upon completion of the Work. Restore area to condition equal to or better than before construction.

END OF SECTION

Section 01610

BASIC PRODUCT REQUIREMENTS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Requirements for transportation, delivery, handling, and storage of Products.

1.02 PRODUCTS

- A. Products: Defined in Document 00700 – General Conditions. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components designated for reuse.
- B. For material and equipment specifically indicated or specified to be reused in the work:
 - 1. Use special care in removal, handling, storage and reinstallation, to assure proper function in completed work.
 - 2. Arrange for transportation, storage and handling of products which require off-site storage, restoration or renovation. Include cost in unit price for related items.
- C. When contract documents require that installation of work comply with manufacturer's printed Instructions, obtain and distribute copies of such instructions to parties involved in installation, including two copies to Project Manager. Maintain one set of complete instructions at job site during installation until completion.
- D. Provide Products from the fewest number of manufacturers as practical, in order to simplify spare parts inventory and to allow for maximum interchangeability of components. For multiple components of the same size, type or application, use the same make and model of component throughout the Work.

1.03 TRANSPORTATION

- A. Make arrangements for transportation, delivery, and handling of Products required for timely completion of the Work.
- B. Transport and handle Products in accordance with manufacturer's instructions.
- C. Consign and address shipping documents to proper party giving name of the Project and its complete street address. Shipments shall be delivered to

Contractor.

1.04 DELIVERY

- A. Arrange deliveries of Products to accommodate short-term site completion schedules and in ample time to facilitate inspection prior to Installation. Avoid deliveries that cause lengthy storage or overburden of limit storage space.
- B. Coordinate deliveries to avoid conflict with the Work and conditions at the site and to accommodate the following:
 - 1. Work of other contractors or the City.
 - 2. Limitations of storage space.
 - 3. Availability of equipment and personnel for handling Products.
 - 4. The City's use of premises.
- C. Have Products delivered to the site in manufacturer's original, unopened, labeled containers.
- D. Immediately upon delivery, inspect shipment to assure:
 - 1. Product complies with requirements of the Contract.
 - 2. Quantities are correct.
 - 3. Containers and packages are intact; labels are legible.
 - 4. Products are properly protected and undamaged.

1.05 PRODUCT HANDLING

- A. Coordinate off-loading of Products delivered to the site. If necessary during construction, move and relocate stored Products at no additional cost to the City.
- B. Provide equipment and personnel necessary to handle Products, including those provided by the City, by methods to prevent damage to Products or packaging.
- C. Provide additional protection during handling as necessary to prevent breaking, scraping, marring, or otherwise damaging Products or surrounding areas.
- D. Handle Products by methods to prevent over-bending or overstressing.

- E. Lift heavy components only at designated lifting points.
- F. Handle Products in accordance with manufacturer's recommendations.
- G. Do not drop, roll, or skid Products off delivery vehicles. Hand-carry or use Suitable materials handling equipment.

1.06 STORAGAE OF PRODUCTS

- A. Store and protect Products in accordance with manufacturer's recommendations and requirements of these Specifications.
- B. Make necessary provisions for safe storage of Products. Place Products so as to prevent damage to any part of the Work or existing facilities and to maintain free access at all times to all parts of the Work and to utility service company installations in the vicinity of the Work. Keep Products neatly and compactly stored in locations that will cause minimum inconvenience to other contractors, public travel, adjoining owners, tenants, and occupants. Arrange storage in a manner so as to provide easy access for inspection.
- C. Restrict storage to areas available on the site for storage of Products as shown on Drawings or approved by Project Manager.
- D. Provide off-site storage and protection when on-site storage is not adequate. Provide addresses of, and access to, off-site storage locations for inspection by Project Manager.
- E. Do not use lawns, grass plots, or other private property for storage purposes without written permission of owner or other person in possession or control of premises.
- F. Protect stored Products against loss or damage.
- G. Store in manufacturers' unopened containers.
- H. Neatly, safely, and compactly stack Products delivered and stored along the line of the Work to avoid inconvenience and damage to property owners and general public, and maintain at least 3 feet clearance around fire hydrants. Keep public, private driveways and street crossings open.
- I. Repair or replace damaged lawns, sidewalks, streets or other improvements to satisfaction of Project Manager. Total length that Products may be distributed along route of construction at one time is 1000 linear feet, unless otherwise approved in writing by Project Manager.

PART 2 P R O D U C T S - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

Section 01630

PRODUCT SUBSTITUTION PROCEDURES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Options for making Product or process selections.
- B. Procedures for proposing equivalent Products or processes, including pre-approved, pre-qualified, and approved Products or processes.

1.02 DEFINITIONS

- A. Product: As defined in Document 00700 – General Conditions. Product does not include machinery and equipment used for production, fabrication, conveying, and erection of the Work. Products may also include existing materials or components designated for reuse.
- B. Process: Any proprietary system or method for installing system components resulting in an integral, functioning part of the Work. For this Section, the word Products includes Processes.

1.03 SELECTION OPTIONS

- A. Pre-approved Products: Construction products of certain manufacturers or Suppliers designated in Specifications as "pre-approved." The City maintains a list of pre-approved products. Pre-approved Products for this Project are designated as pre-approved in Specifications. Products of other manufacturers or suppliers are not acceptable for this Project and will not be considered under the submittal process for approving alternate products.
- B. Pre-qualified Products: Construction products of certain manufacturers or Suppliers designated in Specifications as "pre-qualified." Pre-qualified Products for this Project are designated as pre-qualified in Specifications. Products of other manufacturers or suppliers are not acceptable for this Project and will not be considered under the submittal process for approving alternate products.
- C. Approved Products: Construction products of certain manufacturers or Suppliers designated in Specifications followed by words "or approved equal." Approval of alternate products not listed in Specifications may be obtained through provisions for product options and substitutions in Document 00700 - General Conditions, and by following submittal procedures specified in

Section 01330- Submittal Procedures. The procedure for approval of alternate products is not applicable to pre-approved or pre-qualified products.

- D. Product Compatibility: To the maximum extent possible, provide Products that are of the same type or function from a single manufacturer, make, or source. Where more than one choice is available, select Product that is compatible with other Products already selected, specified, or in use by the City.

1.04 CONTRACTOR'S RESPONSIBILITY

- A. Responsibility related to Product options and substitutions is defined in Document 00700 - General Conditions.
- B. Furnish information Project Manager deems necessary to judge equivalency of alternate Product.
- C. Pay for laboratory testing, as well as any other review or examination costs, needed to establish equivalency between products in order to obtain information upon which Project Manager can base a decision.
- D. If Project Manager determines alternate product is not equal to that named in Specifications, Furnish one of the specified Products.

1.05 CITY REVIEW

- A. Use alternate Products only when approved in writing by Project Manager. Project Manager's determination regarding acceptance of proposed alternate Product is final.
- B. Alternate Products shall be accepted if Products are judged by Project Manager to be equivalent to specified Product or to offer substantial benefit to the City.
- C. The City retains the right to accept any Product deemed advantageous to the City, and similarly, to reject any product deemed not beneficial to City.

1.06 SUBSTITUTION PROCEDURE

- A. Collect and assemble technical information applicable to the proposed Product to aid in determining equivalency as related to the approved Product specified.
- B. Submit a written request for a construction Product to be considered as an alternate Product.

- C. Submit Product information after the effective date of the Contract and within the time period allowed for substitution submittals given in Document 00700 - General Conditions. After the submittal period has expired, requests for alternate Products shall be considered only when specified Product becomes unavailable because of conditions beyond Contractor's control.

- D. Submit five copies of each request for alternate Product approval. Include the following information:
 - 1. Complete data substantiating compliance of proposed substitution with the Contract.
 - 2. For Products:
 - a. Product identification, including manufacturer's name and address.
 - b. Manufacturer's literature with Product description, performance and test data, and reference standards.
 - c. Samples, as applicable.
 - d. Name and address of similar projects on which Product was used and date of installation. Include names of Owner, design consultant, and installing contractor.
 - 3. For construction methods:
 - a. Detailed description of proposed method.
 - b. Drawings illustrating methods.
 - 4. Itemized comparison of proposed substitution with Product or method specified.
 - 5. Data relating to changes in Construction Schedule.
 - 6. Relation to separate contracts, if any.
 - 7. Accurate cost data on proposed substitution in comparison with Product or method specified.
 - 8. Other information requested by Project Manager.

- E. Approved alternate Products will be subject to the same review process as the specified Product would have been for Shop Drawings, Product Data, and Samples.

PART 2 P R O D U C T S - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

Section 01725

FIELD SURVEYING

PART 1 G E N E R A L

1.01 QUALITY CONTROL

- A. Conform to State of Texas laws for surveys requiring licensed surveyors. Employ a surveyor acceptable to Project Manager if required by the Contract.

1.02 MEASUREMENT AND PAYMENT

A. UNIT PRICES

- 1. No separate payment will be made for field surveying. Include cost in unit price for related items.

1.03 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit name, address, and telephone number of Surveyor to Project Manager before starting survey work.
- C. Submit documentation verifying accuracy of survey work on request.
- D. Submit certificate signed by Surveyor, that elevations and locations of the Work are in conformance with the Contract.

1.04 PROJECT RECORD DOCUMENTS

- A. Maintain a complete and accurate log of control and survey work as it progresses.
- B. Prepare a certified survey setting forth dimensions, locations, angles, and elevations of construction and site work upon completion of foundation walls and major site improvements.
- C. Submit record documents under provisions of Section 01785 - Project Record Documents.

1.05 EXAMINATION

- A. Verify locations of survey control points prior to starting the Work.

- B. Notify Project Manager immediately if any discrepancies are discovered.

1.06 SURVEY REFERENCE POINTS

- A. The City will establish survey control datum as provided in Document 00700 - General Conditions and as indicated on Drawings. Inform Project Manager in Advance of time horizontal and vertical control points will be established so verification deemed necessary by Project Manager may be done with minimum inconvenience to the City or Contractor.
- B. Locate and protect survey control points prior to starting site work; preserve permanent reference points during construction.
- C. Notify Project Manager a minimum of 48 hours before relocation of reference points is needed due to changes in grades or other reasons.
- D. Promptly report loss or destruction of reference points to Project Manager.
- E. Reimburse the City for cost of reestablishment of permanent reference points disturbed by construction operations.

1.07 SURVEY REQUIREMENTS

- A. Utilize recognized engineering survey practices.
- B. Establish a minimum of two permanent benchmarks on site, referenced to established control points. Record horizontal and vertical location data on Project record documents.
- C. Establish elevations, lines and levels to provide quantities required for measurement and payment and for appropriate controls for the Work. Locate and lay out the following with appropriate instruments:
 - 1. Site improvements including grading, fill and topsoil placement, utilities, and footings and slabs
 - 2. Grid or axis for structures
 - 3. Building foundation, column locations, and ground floor elevations
- D. Periodically verify layouts.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

Section 01731

CUTTING AND PATCHING

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Cutting, patching and fitting of the Work or work under construction. Coordinating Installation or connection of the Work to existing facilities, or uncovering work for access, inspection or testing and related submittals.

1.02 MEASUREMENT AND PAYMENT

A. UNIT PRICES

- 1. No separate payment will be made for cutting and patching. Include cost in unit price for related items.

1.03 CUTTING AND PATCHING

- A. Perform activities to avoid interference with facility operations and work of others in accordance with Document 00700 - General Conditions of Contract.
- B. Execute cutting and patching, including excavation, backfill and fitting to:
 - 1. Remove and replace defective work or work not conforming to Drawings and Specifications;
 - 2. Take samples of installed work as required for testing;
 - 3. Remove construction required to provide for specified alterations or additions to existing work;
 - 4. Uncover work to allow inspection or reinspection by Project Manager or regulatory agencies having jurisdiction;
 - 5. Connect uninstalled work to completed work in proper sequence;
 - 6. Remove or relocate existing utilities and pipes that obstruct work;
 - 7. Make connections or alterations to existing or new facilities;
 - 8. Provide openings, channels, chases and flues and cut, patch, and finish; if required; or

9. Provide protection for other portions of the Work.
- C. Restore existing work to a condition equal to or better than that which existed Prior to cutting and patching, and to standards required by Specifications.
- D. Support, anchor, attach, match, trim and seal materials to work of others. Unless otherwise specified, Furnish and Install sleeves, inserts, and hangers required for execution of the Work.
- E. Provide shoring, bracing and support necessary to maintain structural integrity and to protect adjacent work from damage during cutting and patching. Request written approval from Project Manager, before cutting structural members such as beams, anchors, lintels, or other supports. Follow approved submittals, as applicable.
- F. Match new materials to existing materials by bonding, lapping, mechanically tying, anchoring or other effective means in order to prevent cracks and to minimize evidence of patching. Conceal effects of demolition and patching by blending new construction to existing surfaces. Avoid obvious breaks, joints or changes of surface appearance unless shown on Drawings or authorized by Project Manager.

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit a written request to Project Manager for consent to proceed, before conducting cutting operations that might affect structural integrity, design function, City operations, or work of another contractor.
- C. Include the following in submittal:
 1. Identification of Project
 2. Description of affected work
 3. Necessity for cutting
 4. Effect on other work and on structural integrity
 5. Describe the proposed work including:
 - a. Scope of cutting and patching
 - b. Contractor, Subcontractor or Supplier who will execute the work
 - c. Proposed Products
 - d. Extent of refinishing
 - e. Schedule of operations

6. Alternatives to cutting and patching
- D. When work conditions or schedules dictate the need for change of materials or methods, submit a written recommendation to Project Manager that includes:
 1. conditions necessitating the change;
 2. recommendations for alternative materials or methods; and
 3. submittals required for proposed substitutions
 - E. Notify Project Manager in writing when work will be uncovered for observation. Do not begin cutting or patching operations until authorized by Project Manager.
- 1.05 CONNECTIONS TO EXISTING FACILITIES
- A. Perform construction operations necessary to complete connections and tie-ins to existing facilities. Keep existing facilities in continuous operation unless otherwise permitted in the Specifications or approved in writing by Project Manager.
 - B. Coordinate interruption of service requiring connection to existing facilities with Project Manager. Do not bypass wastewater or sludge to waterways. Provide temporary pumping facilities to handle wastewater if necessary. Use temporary bulkheads to minimize disruption. Provide temporary power and piping to facilitate construction where necessary.
 - C. Submit a detailed schedule of proposed connections, including shut-downs and tie-ins. Include proposed time and date as well as anticipated duration of work. Coordinate the connection schedule with the construction schedule.
 1. Submit specific times and dates to Project Manager at least 48 hours in advance of proposed work.
 - D. Procedures and Operations:
 1. Operate existing pumps, valves and gates in required sequence under supervision of Project Manager. Do not operate valves, gates or other items of equipment without Project Manager's knowledge.
 2. If possible, test equipment under operating conditions before making final tie-ins to connect equipment to existing facility.
 3. Coordinate work and schedules. Notify Project Manger at least 48 Hours before shutdowns or bypasses are required.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

Section 01732

PROCEDURE FOR WATER VALVE ASSISTANCE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Operation of valves. City of Houston employees will operate existing valves. Contractor's employees may operate new valves included in the Project prior to acceptance by the City.

1.02 PROCEDURE

- A. Perform activities listed in Exhibit A attached to this Section.

1.03 SUBMITTALS

- A. Submit request for work order planning meetings in accordance with Exhibit A. Include information listed in Step 1 of Exhibit A, attached to this Section.

1.04 CANCELLATION

- A. Contractor, Project Manager, or Public Utilities Division may cancel a scheduled valve assistance appointment at no extra cost or payment to Contractor. Contractor shall notify City's appointed Project Inspector ("Inspector") 24 hours in advance of cancellation. Inspector shall notify Central Operation Service (COS) immediately upon receipt of cancellation notice. Cancellation may be caused by bad weather, preparation work taking longer than anticipated, or unforeseen delays by one or more of the three parties.

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

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EXHIBIT A

PROCEDURE FOR VALVE ASSISTANCE

The following procedure will be used by Utility Maintenance Branch personnel when completing a service request from individual Contractors, through Inspector, for operation of existing water valves.

ROUTINE VALVE ASSISTANCE REQUEST (NON-EMERGENCY JOBS):

- Step 1.** a. When notified by Contractor, Inspector will schedule a work order planning meeting by calling Central Operation Service (COS) at **(713) 295-5521** and providing information shown below. The work order planning meeting shall be conducted a minimum of three days after the request; excluding weekends, holidays, inclement weather days, and the day of the call.

Location of Work (Street Intersection)	Project #
Project Description	Contractor (Company Name)
Job Superintendent's Name	Superintendent's Office #/Mobile #/Pager #
Contractor's Emergency Information	Name and Phone #/Mobile #/Pager #
Inspector/Senior Inspector	Name, Phone #/Mobile #/Pager #
Date & Time assistance is requested	

- b. COS will create a work order for each wet connection, cut and plug, etc. that will be designated as a "Code 40" (Private Contractor).
- c. COS will give Inspector the work order number. This work order number must be used as a reference in all communications regarding this request for Valve Assistance.
- d. Valve personnel must have the work order number on their route sheet. When valve personnel arrive at the job site for the Work Order Planning Meeting between Inspector, Contractor, and Utility Maintenance valve personnel, they will verify the street intersection and work order number with the Inspector before beginning Work Order Planning Meeting.
- e. During Work Order Planning Meeting, the work to be performed will be outlined and the actual date work will be performed will be mutually determined by Inspector, Contractor and City's Utility Maintenance Division valve personnel, based upon relevant factors such as preparatory work needed, customer requirements, etc.
- f. Valve personnel will perform work specifically outlined in the work order requested. Also, Utility Maintenance Branch valve personnel will only operate existing water valves. Inspector must contact COS and request a new work order for additional work.

- g. Valve personnel will contact the dispatcher and advise when the job is complete. Valve personnel will list all appropriate information on the Crew Activity Report.

Step 2. Should valve personnel not be able to keep an appointment to provide valve assistance, Utility Maintenance Branch will provide notification to appropriate Inspector by phone at least 24 hours prior, with that fact and rescheduling information, if available.

Step 3. Inspector will notify COS if valve personnel have not arrived at the site within 30 minutes of scheduled appointment. If Contractor is not ready when valve operator arrives to provide valve assistance, the City shall charge Contractor \$50.00 per hour, starting 15 minutes after the scheduled appointment time, minimum one hour charge.

Step 4. Contractor will not be due delay claims or downtime if Utility Maintenance Branch has notified Inspector that they will not be able to provide valve assistance as scheduled.

Step 5. Test installed new valves in the presence of Inspector before substantial completion inspection is scheduled. Place new valves in open position on or before the Date of Substantial Completion.

Step 6. Project Manager will notify, in writing, Utility Maintenance Branch two months before the warranty expires to report any problems they have with new water lines. Project Manager will notify Contractor about these problems.

EMERGENCY REQUEST FOR VALVE ASSISTANCE PROCEDURE:

- Step 1.** When notified by Contractor, Inspector will request emergency Valve Assistance due to a broken line/service, etc. by calling COS at **(713) 295-5521** and providing the following information:
- | | |
|--|--|
| Location of Work (Street Intersection) | Project # |
| Project Description | Superintendent's Office #/Mobile #/Pager # |
| Contractor (Company Name) | Name and Phone #/Mobile #/Pager # |
| Job Superintendent's Name | Name, Phone #/Mobile #/Pager # |
| Contractor's Emergency Information | |
| Inspector/Senior Inspector | |
| Date & Time assistance is requested | |
- Step 2.** COS will create an emergency work order number and describe the work to be performed.
- Step 3.** COS will give Inspector the emergency work order number. Reference work order number in all communications regarding request for Valve Assistance.
- Step 4.** COS will contact designated valve personnel and assign emergency work order. Dispatcher will follow standard COS procedures if this situation occurs after normal working hours.
- Step 5.** Valve personnel must have the emergency work order number on the route sheet. When valve personnel arrive at the job site for emergency work, they will verify the street intersection and emergency work order number with Inspector prior to beginning work requested for operating existing water valves. Valve personnel will coordinate verification of street intersection and work order number with Inspector prior to performing work.

Section 01740-S

SITE RESTORATION

The following supplements modify Section 01740 – Site Restoration Standard Specification. Where a portion of the Specification is modified or deleted by this Supplementary Specification, the unaltered portions of the Specification shall remain in effect.

1.02 UNIT PRICES: *Delete Sections A and B and replace with the following.*

- A. Payment for regular restoration of the paved area of the Project site disturbed by the construction operations shall be as defined in Document 00410B – Bid Form Part B.
- B. Unpaved Surface Restoration.
 - 1. All unpaved surface restoration, including cleaning, sodding, hydroseeding, and protecting, removing, and restoring landscaping and fencing associated with Odor Control Improvements is incidental and shall be included in applicable Bid items.
 - 2. No unit price payment shall be made for fence removal and replacement associated with Contractor's equipment access or work performance. Payment for removal and replacement of existing fencing shall be considered incidental to applicable Bid items.

1.03 SCHEDULING: *Delete Sections B and C.*

END OF SECTION

Section 01740

SITE RESTORATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Restoration of site affected by the Work in public or private property, including pavement, esplanades, sidewalks, driveways, fences, lawns and landscaping.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for restoration of Project site disturbed by utility construction operations is on a linear foot basis. Measurement will be as provided for corresponding utility in each Specification section. No separate payment made for branch pipe, valves and, other associated work for utilities. Measurement for restoration with multiple utilities within the same right-of-way will be on a linear foot basis for only one utility.
2. No separate payment made for facility or roadway projects. Include cost in the surface improvements associated with the facility or roadway construction.
3. Payment includes required site restoration within the right-of-way or easement regardless of size or type of pipe, method of construction, paved or unpaved areas or thickness and width of pavement.
4. No separate payment made for site restoration for service connections under this Section. Include cost in appropriate utility section.
5. Refer to Section 01270 – Measurement and Payment for Unit Price procedures.

- B. Stipulated Price (Lump Sum) Contracts. If Contract is Stipulated Price Contract, include payment for work under this section in total Stipulated Price.

1.03 DEFINITIONS

- A. Phase: Locations identified on the plans and listed in Section 1110 – Summary of Work under Work Sequence.

- B. Site Restoration: Replacement or reconstruction of Site Improvements located in rights-of-way, easements, public property, and private property affected or altered by the Work.
- C. Site Improvement: Includes pavement, curbs and gutters, esplanades, sidewalks, driveways, fences, lawns, irrigation systems, landscaping, and other improvements in existence at the Project site before commencement of construction operations.

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Schedule of testing, service connections, abandonment, backfill, and site restoration.
- C. Sample of notices to residents outlining their responsibility for maintenance of site improvements adjacent to the Project that are not disturbed by construction operations

1.05 SCHEDULING

- A. Schedule testing, service connections, abandonment, backfill and site restoration immediately following completion of pipe laying work or paving within each block or line segment.
- B. Phased Construction:
 - 1. Commencement of subsequent Phase will follow scheduling of site restoration of prior Phase. Limit work to a maximum of two Phases of the project.
- C. Construction of Projects with no Phases listed in Section 01110- Summary of Work:
 - 1. Complete site restoration prior to disturbing over 50% of total project linear feet or 2,000 linear feet, whichever is greater, of right-of-way or easement.
 - 2. Limit work to a maximum of 50% of total project linear feet or 2,000 linear feet, whichever is greater, of right-of-way and easement. Commence work in additional right-of-way or easement after completion of site restoration.

PART 2 P R O D U C T S

2.01 MATERIALS

- A. Pavement, Sidewalks and Driveways: Materials specified in Section 02951 - Pavement Repair and Resurfacing.
- B. Seeding and Sodding: Sod specified in Section 02922 - Sodding and Seed specified in Section 02921 - Hydromulch Seeding.
- C. Trees, Shrubs and Plantings: Conform to requirements of Section 01562 – Tree and Plant Protection.

PART 3 E X E C U T I O N

3.01 Preparatory Work

- A. Provide cleanup and restoration crews to work closely behind pipe laying and roadway construction crews, and where necessary, during testing, service restoration, abandonment, backfill and surface restoration.
- B. Water Lines: Unless otherwise approved by Project Manager, comply with the following:
 - 1. Once Project Manager approves work within a Phase, immediately begin preparatory work for disinfection effort.
 - 2. No later than three days after completing disinfection preparatory work, submit to City appropriate request for disinfection.
 - 3. If City fails to perform initial disinfection of lines in accordance with Section 2514 - Disinfection of Water Lines, within seven days from submission of appropriate request, and if approved by Project Manager, pipe laying operations may continue beyond approved limits until the City responds.
 - 4. Immediately after transfer of services, begin abandonment of old water lines and site restoration.
- C. Wastewater Lines:
 - 1. Once Project Manager approves work within a Line Segment, immediately begin preparatory work for testing effort.

2. No later than three days after completing preparatory work for testing, initiate testing work.
3. Immediately after transfer of service connections, begin abandonment of old wastewater lines, and site restoration.

D. Street Construction and Paving Projects

1. Once Project Manager approves work within a Line Segment or block, immediately begin preparatory work for testing effort.
2. No later than three days after completing preparatory work for testing, initiate testing work.
3. Immediately after testing begin site restoration.

E. Street Construction and Paving Projects

1. Once Project Manager approves work within a block, immediately begin preparatory work for sidewalk construction, sodding and hydromulching and tree planting.
2. No later than seven days after completing preparatory work, initiate construction.

3.02 CLEANING

- A. Remove debris and trash to maintain a clean and orderly site in accordance with requirements of General Conditions and Section 01576 - Waste Material Disposal.

3.03 LANDSCAPING AND FENCES

A. Seeding and Sodding.

1. Remove construction debris and level area with bank sand so that new grass surface matches level of existing grass and maintains pre-construction drainage patterns. Level and fill minor ruts or depressions caused by construction operations with bank sand, where grass is still viable.
2. Restore previously existing turfed areas with sod and fertilize in accordance with Section 02922 - Sodding. Sod to match existing turf.

3. Restore unpaved areas not requiring sodding with hydromulch seeding conforming to Section 02921 - Hydromulch Seeding.
- B. Trees, Shrubbery and Plants.
1. Remove and replant trees, shrubs, and plants in accordance with requirements of Section 01562 – Tree and Plant Protection.
- C. Fence Replacement.
1. Replace removed or damaged fencing to equal or better condition than existed prior to construction, including concrete footings and mow strips. Provide new wood posts, top and bottom railing and panels. Metal fencing material, not damaged by the Work, may be reused.
 2. Remove and dispose of damaged or substandard material.
- 3.04 MAINTENANCE
- A. Maintain shrubs, plantings, sodded areas and seeded areas.
- B. Replace shrubs, plantings and seeded or sodded areas that fail to become established.
- C. Refer to Section 01562 - Tree and Plant Protection, Section 02921 - Hydromulch Seeding and Section 02922 - Sodding for maintenance requirements.

END OF SECTION

Section 01755

STARTING SYSTEMS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Starting systems.
- B. Demonstration and instructions.
- C. Testing, adjusting and balancing.

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. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Project Manager seven days prior to startup of each item.
- C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other damage-causing conditions.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision in accordance with manufacturer's instructions.
- G. When specified in individual Specification sections, require manufacturer to provide an authorized representative to be present at the site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

- H. Submit written report indicating that equipment or system has been properly installed and is functioning correctly.

3.02 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Project Manager two weeks prior to Date of Substantial Completion.
- B. Utilize O&M Manuals as the basis for instruction. Review contents of manual with Project Manager in detail to explain aspects of operation and maintenance.
- C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at the equipment location.
- D. Prepare and insert additional data in O&M Manuals when the need for additional data becomes apparent during instruction.
- E. At a minimum, Contractor will demonstrate the following:
 - 1. Products and procedures to be used in maintaining various surfaces, e.g., counter tops, toilet partitions, tile floors and carpeting;
 - 2. procedures to set and maintain landscape irrigation system;
 - 3. procedures to set and maintain security and fire alarm systems; and
 - 4. procedures to set and maintain HVAC systems.

3.03 TESTING, ADJUSTING AND BALANCING

- A. Contractor shall appoint, employ and pay for the services of an independent firm to perform testing, adjusting and balancing.
- B. Submit reports by the independent firm to Project Manager describing observations and results of tests and signifying compliance or non-compliance with specified requirements and requirements of the Contract.

END OF SECTION

Section 01770

CLOSEOUT PROCEDURES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Procedures to establish Date of Substantial Completion.
- B. Closeout procedures for final submittals, O&M data, warranties, spare parts and maintenance materials.
- C. Texas Department of Licensing and Regulation (TDLR) inspection for Texas Accessibility Standards (TAS) compliance.

1.02 SUBSTANTIAL COMPLETION

- A. Comply with Document 00700 - General Conditions regarding Date of Substantial Completion when Contractor considers the Work, or portion thereof designated by Project Manager, to be substantially complete.
- B. Insure the following items have been completed when included in the Work, prior to presenting a list of items to be inspected by Project Manager for issuance of a Certificate of Substantial Completion:
 - 1. cutting, plugging, and abandoning of water, wastewater, and storm sewer lines, as required by Contract documents for each item;
 - 2. construction of, and repairs to, pavement, driveways, sidewalks, and curbs and gutters;
 - 3. sodding and hydromulch seeding, unless waived by Project Manager in writing;
 - 4. general clean up including pavement markings, transfer of services, successful testing and landscape;
 - 5. additional requirements contained in Section 01110 - Summary of Work.
- C. Assist Project Manager with inspection of Contractor's list of items and complete or correct the items, including items added by Project Manager, within specified time period.

CLOSEOUT PROCEDURES

CITY OF HOUSTON STANDARD GENERAL REQUIREMENT

- D. Should Project Manager's inspection show failure of Contractor to comply with requirements to obtain Date of Substantial Completion, including those items in Paragraph 1.02 B. of this section, Contractor shall complete or correct the items, before requesting another inspection by Project Manager.

1.03 CLOSEOUT PROCEDURES

- A. Comply with Document 00700 - General Conditions regarding final completion and final payment when the Work is complete and ready for Project Manager's final inspection.
- B. Provide Project Record Documents in accordance with Section 01785 - Project Record Documents.
- C. Complete or correct items on punch list, with no new items added. Address new items during warranty period.
- D. The City will occupy portions of the Work as specified in other sections.

1.04 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. For facilities, clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Clean equipment and fixtures to sanitary condition.
- D. Clean or replace filters of operating equipment.
- E. Clean debris from roofs, gutters, down spouts, and drainage systems.
- F. Clean site; sweep paved areas, and rake clean landscaped surfaces.
- G. Remove waste and surplus materials, rubbish, and temporary construction facilities from site following final test of utilities and completion of the Work.

1.05 ADJUSTING

- A. Adjust operating equipment to ensure smooth and unhindered operation. Value of this testing and adjusting is five percent of Lump Sum Price in the Schedule of Values for item being tested.

1.06 OPERATION AND MAINTENANCE DATA

- A. Submit O&M data as noted in Section 01330 - Submittal Procedures.
- B. Five percent of lump sum amount of each piece of equipment as indicated in Schedule of Unit Price Work or Schedule of Values will be paid after the required O&M data submittals are received and approved by Project Manager.

1.07 WARRANTIES

- A. Provide one original of each warranty from Subcontractors, Suppliers, and manufacturers.
- B. Provide Table of Contents and assemble warranties in a 3-ring/D binder with durable plastic cover.
- C. Submit warranties prior to final progress payment.
- D. Warranties shall commence in accordance with the requirements in Document 00700 - General Conditions.

1.08 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide Products, spare parts, maintenance and extra materials in quantities specified in individual Specification sections.
- B. Deliver to a location within the City limits as directed by Project Manager. Applicable items must be delivered prior to issuance of a final Certificate for Payment.

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 01782

OPERATIONS AND MAINTENANCE DATA

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Submittal requirements for equipment and facility Operations and Maintenance (O&M) Manuals

1.02 MEASUREMENT AND PAYMENT

- A. Measurement for equipment O&M Manuals is on a lump sum basis equal to five percent of the individual equipment value contained in Schedule of Unit Prices or Schedule of Values. The lump sum amount may be included in the first Progress Payment following approval of the O&M Manuals by Project Manager.

1.03 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures. Submit a list of O&M Manuals and parts manuals for equipment to be incorporated into the Work.
- B. Submit documents with 8-1/2 x 11-inch text pages, bound in 3-ring/D binders with durable plastic covers.
- C. Print "OPERATION AND MAINTENANCE INSTRUCTIONS", Project name, and subject matter of binder on covers when multiple binders are required.
- D. Subdivide contents with permanent page dividers, logically organized according to the Table of Contents, with tab titling clearly printed under reinforced laminated plastic tabs.
- E. O&M Manual contents: Prepare a Table of Contents for each volume, with each Product or system description identified.
 - 1. Part 1 - Directory: Listing of names, addresses, and telephone numbers of Design Consultant, Contractor, Subcontractors, and major equipment Suppliers.

2. Part 2 - O&M instructions arranged by system. For each category, identify names, addresses, and telephone numbers of Subcontractors and Suppliers and include the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
3. Part 3 - Project documents and certificates including:
 - a. Shop Drawings and relevant data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Photocopies of warranties.

F. Submit two copies of O&M Manuals and parts manuals, for review, within one month prior to placing the equipment or facility in service.

G. Submit one copy of completed volumes in final form 10 days prior to final inspection. One copy with Project Manager comments will be returned after final inspection. Revise content of documents based on Project Manager's comments prior to final submittal.

H. Revise and resubmit three final volumes within 10 days after final inspection.

1.04 EQUIPMENT O&M DATA

A. Furnish O&M Manuals, prepared by manufacturers for all equipment. Manuals must contain, as a minimum, the following:

1. Equipment functions, normal operating characteristics, and limiting conditions.
2. Assembly, Installation, alignment, adjustment, and checking instructions.
3. Operating instructions for start-up, normal operation, regulation and control, normal shutdown, and emergency shutdown.
4. Detailed drawings showing the location of each maintainable part and lubrication point with detailed instructions on disassembly and reassembly of the equipment.

5. Troubleshooting guide.
 6. Spare parts list, predicted life of parts subject to wear, lists of spare parts recommended to be on hand for both initial start-up and for normal operating inventory, and local or nearest source of spare parts availability.
 7. Outline, cross-section, and assembly drawings with engineering data and wiring diagrams.
 8. Test data and performance curves.
- B. Furnish parts manuals for all equipment, prepared by the equipment manufacturer, which contain, as a minimum, the following:
1. Detailed drawings giving the location of each maintainable part.
 2. Spare parts list with predicted life of parts subject to wear, lists of spare parts recommended on hand for both initial start-up and for normal operating inventory, and local or nearest source of spare parts availability.

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 01785

PROJECT RECORD DOCUMENTS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Maintenance and submittal of record documents and Samples.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Maintain one record copy of documents at the site in accordance with Document 00700 - General Conditions.
- B. Store record documents and Samples in field office, if a field office is required by the Contract, or in a secure location. Provide files, racks, and secure storage for record documents and Samples.
- C. Label each document "PROJECT RECORD" in neat, large, printed letters.
- D. Maintain record documents in a clean, dry, and legible condition. Do not use record documents for construction purposes. Do not use permit drawings to record Modifications to the Work.
- E. Keep record documents and Samples available for inspection by Project Manager.
- F. Bring record documents to progress review meetings for viewing by Project Manager and, if applicable, Design Consultant.

1.03 RECORDING

- A. Record information legibly with red ink pen on a set of blueline opaque drawings, concurrently with construction progress. Maintain an instrument on site at all times for measuring elevations accurately. Do not conceal work until required information is recorded
- B. Contract Drawings and Shop Drawings: Mark each item to record completed Modifications, or when minor deviations exist, the actual construction including:
 - 1. Measured depths of elements of foundation in relation to finish first floor datum.
 - 2. Measured horizontal locations and elevations of Underground Facilities and appurtenances, referenced to permanent surface improvements.

3. Elevations of Underground Facilities referenced to City of Houston benchmark utilized for the Work.
 4. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 5. Dimensions and details of field changes
 6. Changes made by Modifications.
 7. Details not on original Drawings.
 8. References to related Shop Drawings and Modifications.
- C. Survey all joints of water mains at the time of construction. Record on Drawings, water main invert elevation, elevation top of manway, and centerline horizontal location relative to baseline.
- D. For large diameter water mains, mark specifications and addenda to record:
1. Manufacturer, trade name, catalog number and Supplier of each Product actually Installed.
 2. Changes made by Modification or field order.
 3. Other matters not originally specified.
- E. Annotate Shop Drawings to record changes made after review.
- 1.04 SUBMITTALS
- A. At closeout of the Contract, deliver Project record documents to Project Manager.

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 02220

DEMOLITION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of facilities, including buildings, structures and other site facilities.
 - 2. Either abandoning in place and/or removing below-grade construction as designated on Drawings.
 - 3. Disconnecting, capping or sealing, and either abandoning in-place or removing site utilities as designated on Drawings.
 - 4. Salvaging items for reuse by Owner.
- B. Related Sections include the following:
 - 1. Division 2 Section 02136 "Waste Material Handling, Testing, and Disposal".
 - 2. Division 2 Section 02221 "Removing Existing Pavements and Structures".
 - 3. Division 2 Section 02233 "Clearing and Grubbing".
 - 4. Division 15 Sections for demolishing or relocating site mechanical items.
 - 5. Division 16 Sections for demolishing or relocating site electrical items.

1.03 DEFINITIONS

- A. Demolish: Completely remove and legally dispose of off-site.
- B. Recycle: Recovery of demolition waste for subsequent processing in preparation for reuse.
- C. Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner. Include fasteners or brackets needed for reattachment elsewhere.

1.04 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner. Carefully salvage in a manner to prevent damage and promptly return to OWNER.

1.05 SUBMITTALS

- A. Proposed Protection Measures: Submit informational report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control, and for noise control. Indicate proposed locations and construction of barriers. Adjacent Facilities: Detail special measures proposed to protect adjacent facilities to remain.
- B. Schedule of Facilities Demolition Activities: Indicate the following:
 - 1. Detailed sequence of demolition work, with starting and ending dates for each activity.
 - 2. Temporary interruption of utility services.
 - 3. Shutoff and capping or re-routing of utility services.

DEMOLITION

- C. Facility Demolition Plans: Drawings indicating the locations of temporary protection and means of egress for adjacent occupied facilities, if applicable.
- D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- E. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by facility demolition operations. Comply with Division 1 Section 01322 "Photographic Documentation." Submit before the Work begins.
- F. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.06 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI A10.6 and NFPA 241.
- C. Pre-demolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section 01310 "Project Management and Coordination."
 - 1. Inspect and discuss condition of construction to be demolished.
 - 2. Review structural load limitations of existing structures.
 - 3. Review and finalize facility demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review and finalize protection requirements.
 - 5. Review procedures for noise control and dust control.
 - 6. Review procedures for protection of adjacent facilities.
 - 7. Review items to be salvaged and returned to Owner.

1.07 PROJECT CONDITIONS

- A. Facilities immediately adjacent to demolition area will be in use. Conduct demolition so operations of these facilities will not be disrupted.
 - 1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent facilities.
 - 2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings and/or operations of adjacent facilities. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent facilities without written permission from authorities having jurisdiction.
- B. Owner assumes no responsibility for buildings, structures, and other facilities to be demolished.
 - 1. OWNER will maintain conditions existing at time of inspection for bidding purpose as far as practical.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Owner will remove hazardous materials before start of the Work.
 - 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify ENGINEER and OWNER. OWNER will remove hazardous materials under a separate contract.
- D. On-site storage or sale of removed items or materials is not permitted.

1.08 COORDINATION

- A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction provided by Owner and ENGINEER. Owner or ENGINEER does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Inventory and record the condition of items to be removed and salvaged.
- D. Perform an engineering survey of condition of facilities to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during demolition operations. Locate tensioned steel tendons and include recommendations for de-tensioning, if applicable.

3.02 PREPARATION

- A. Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.
- B. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving facilities to be demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings or operating facilities, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings, structures, and facilities.
 - 3. Cut off pipe or conduit a minimum of 24 inches below grade. Remove cables or wires from conduit back to power source. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
 - 4. At power surface remove any identification and installed plate identifying as 'Spare' or 'Not in Service.'
- C. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished. Strengthen or add new supports when required during progress of demolition.
- D. Salvaged Items: Comply with the following:
 - 1. Clean salvaged items of dirt and demolition debris.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.

3.03 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other facilities during demolition operations. Maintain exits from existing facilities.
- B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.
 - 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.

DEMOLITION

2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
 - a. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.
- C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction, and as indicated. Comply with requirements in Division 1 Section 01500 "Temporary Facilities and Controls."
 1. Protect adjacent buildings and facilities from damage due to demolition activities.
 2. Protect existing site improvements, appurtenances, and landscaping to remain.
 3. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 4. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
 5. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
- D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.04 DEMOLITION, GENERAL

- A. General: Demolish indicated existing buildings, structures, and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 2. Maintain fire watch during and for at least 4 hours after flame cutting operations.
 3. Maintain adequate ventilation when using cutting torches.
 4. Locate demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from facilities demolition activities.
- C. Site Access and Temporary Controls: Conduct demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- D. Explosives: Use of explosives is not permitted.

3.05 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Remove debris from elevated portions of the facilities by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- C. Salvage: Items to be salvaged are indicated below:
 1. Biological Trickling Filter Tower–type Odor Control System, including vessels, ductwork, motor and irrigation control panels, blowers and motors, and other miscellaneous appurtances.
 2. Fiberglass Storage Structures
 3. Chemical Feed Pumps
 4. Calcium Nitrate Bulk Storage Tank
- D. Below-Grade Construction: Demolish foundation walls and other below-grade construction that are within footprint of new construction and extending 5 feet outside footprint indicated for new construction. Abandon below-grade construction outside this area. Remove below-grade construction, including basements, foundation walls, and footings, to at least 12 inches below grade.
- E. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.
 1. Remove existing utilities and piping that are within 5 feet outside footprint indicated for new construction.
 2. Abandon utilities outside this area by plugging pipes and removing cables within conduits back to motor control centers or source.
 3. Remove nameplate from motor starters or panelboards and replace with new nameplate identified as “Spare.”
 4. Remove all underground utility structures and fill in accordance with Section 02300 “Earthwork.” If within roadways, replace with like paving materials.

3.06 SITE RESTORATION

- A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Division 2 Section "Earthwork."
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.07 REPAIRS

- A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.08 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction.
 1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

3.09 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing before demolition operations began.

END OF SECTION

Section 02752-S

CONCRETE PAVEMENT JOINTS

The following supplements modify Section 02752 – Concrete Pavement Joints Standard Specification. Where a portion of the Specification is modified or deleted by this Supplementary Specification, the unaltered portions of the Specification shall remain in effect.

1.02 MEASUREMENT AND PAYMENT: *Delete Paragraph A and replace with the following:*

A. Unit Prices.

1. No payment will be made for expansion joints, preformed expansion joints, horizontal dowels, contraction joints, or concrete driveway joints. Include payment in unit price for the appropriate unit price item defined in Document 00410B – Bid Form Part B.
2. Payment for saw joint of concrete/asphalt pavement shall be included in the appropriate unit price item defined in Document 00410B – Bid Form Part B.

END OF SECTION

Section 02821

CHAIN-LINK FENCES AND GATES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Fence framework, fabric, and accessories.
- B. Excavation for post bases, concrete foundation for posts and center drop for gates.
- C. Manual gates and related hardware.

1.03 MEASUREMENT AND PAYMENT

- A. No payment shall be made for fence removal and replacement for the Contractor's equipment access or work performance. Removal and replacement shall be considered incidental. The Contractor is responsible to repair/replace any fence materials damaged in the process of removal and replacement.
- B. Payment for the gate shall be per unit.
- C. Refer to Section 01270 – Measurement and payment for unit price procedures.

1.04 DEFINITIONS AND REFERENCES

A. Definition:

- 1. Posts: Vertical members of the fence.
- 2. End, corner, and pull posts are posts at which chain link fence terminates.
- 3. Gate posts are posts at which gates are either attached or latched.
- 4. Line posts are posts that occur in a line of fence in which the chain link fabric passes and to which it is tied.
- 5. Rails: Horizontal members of the fence; may be top, bottom, intermediate or brace rails.

B. References:

- 1. ASTM/ANSI A 123 – Zinc (Hot Dip Galvanize) Coatings on Iron and Steel Products.
- 2. ASTM/ANSI F 567 – Practice for Installation of Chain-Link Fence
- 3. ASTM A 392 – Zinc-Coated Steel Chain-Link Fence Fabric
- 4. ASTM F 668 – Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric
- 5. ASTM A 120 – Pipe, steel, black and hot-dipped zinc coated (galvanized) welded and seamless for ordinary uses.
- 6. ASTM F 900 – Industrial and commercial swing gates.
- 7. FS RR – F-191 – Fencing, wire, and post metal (and gates, chain link fence fabric, and accessories).

1.05 SUBMITTALS

- A. Submit under provisions of Section 01330 - Submittals

- B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.
- C. Product Data: Provide data on fabric, posts, accessories, fittings, and hardware that indicates items match or exceed the quality of existing items.

1.06 FIELD MEASUREMENTS

Verify that field measurements are as indicated on the shop drawings.

PART 2 PRODUCTS

2.01 QUALIFICATIONS

Manufacturer shall be a company specializing in the products specified in this Section with a minimum of three years of experience.

2.02 MATERIALS

A. CHAIN-LINK FENCE FABRIC

- 1. General: Height to match existing fence and gate. Comply with ASTM A 392, CLFMI CLF 2445, and requirements indicated below:
- 2. Steel Wire Fabric: Metallic coated wire with a diameter of 0.148 inch (9 gauge).
- 3. Mesh Size: 2 inches.
- 4. Metallic (Zinc) Coating: ASTM A 392, Class II, 2.0 oz/sq. ft, minimum.
- 5. Polymer Coating: ASTM F 668, Class 2b over metallic-coated steel wire.
- 6. Color: Brown to match existing, complying with ASTM F 934.
- 7. Selvage: Knuckled at both selvages for fabrics less than 6-feet high. Twisted top and knuckled bottom for fabrics 6-feet and higher.

B. INDUSTRIAL FENCE FRAMING POSTS AND RAILS

- 1. Comply with ASTM F 1043 for framing, ASTM F 1083 and the following:
 - a. Material Group: IA, round steel pipe, Schedule 40, or 1C steel pipe.
 - b. Fence Height: 6 feet.
 - c. Strength Requirement: Heavy industrial according to ASTM F 1043, Table 3.
 - d. Minimum Sizes (outside diameter):
 - 1) Rail or braces: 1.660-inches.
 - 2) Line Post: 2.375-inches.
 - 3) End, Corner, and Terminal Posts: 2.875-inches.
 - 4) Gate Posts:
 - a) Gate Leaf Width, 12-feet or less: 4.000-inches.
 - b) Gate Leaf Width, over 12-feet to 18-feet: 6.625-inches.
 - c) Gate Leaf Width, over 18-feet to 24-feet: 8.625-inches.
 - e. Install horizontal braces fabricated of 1-5/8-inch, 2.27-lb copper bearing steel pipe at all corner, gate, and end posts.
 - f. Coating for Steel Framing: Metallic coating, 2.0 ounces/sq. ft. minimum or one ounce/sf plus 30 micrograms /square-inch chromate conversion coating.

C. TENSION WIRE

- 1. General: Provide horizontal tension wire at top and bottom of fence fabric. If fence has a top rail, top tension wire not required.
- 2. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824.

D. FABRIC TIES

Fabric ties shall be hog rings, galvanized steel wire not less than 9-ga with a zinc coating of not less than 1.2 ounces/sf.

- E. **BOLTS AND NUTS**
Bolts and nuts shall be in conformance with ASTM A 307 and shall be galvanized in accordance with AASHTO M 232.
- F. **INDUSTRIAL SWING GATES**
 - 1. General: Comply with ASTM F 900 for single or double swing gate types as indicated on Drawings.
 - 2. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings.
 - 3. Frames and Bracing: Fabricate members from round, galvanized steel tubing with outside dimension and weight according to ASTM F 900 and the following:
 - a. Gate Fabric Height: Match existing.
 - b. Leaf Width: As shown on Drawings.
 - c. Frame Members: 2-inch outside diameter castings.
 - d. Frame Corner Construction: Welded or assembled with corner fittings and 5/16-inch-diameter, adjustable truss rods for panels 5 feet wide or wider.
 - 4. Hardware: Latches permitting operation from both sides of gate, two hinges per leaf that match the degree of swing for the existing gate, center gate stop and drop rod for double gates, mechanical keepers for each gate leaf more than 5 feet wide, and padlock hardware and padlocks with 3 keys each.
- B. **PRIVACY SLATS**
 - 1. Material: Redwood.
 - 2. Color: Match Existing

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install chain link fence in accordance with the directions of the manufacturer and these specifications.
- B. Install fence posts at not more than 10-foot centers and at least 36 inches into the ground in a Class B concrete base. Allow concrete to cure for at least 7 days before erecting remainder of the fence. Fasten fabric to line posts with wire ties spaced about 14 inches apart and to top rail spaced about 24 inches apart.
- C. Use standard chain link fence stretching equipment to stretch the fabric before tying in to the rails and posts. Repeat the stretching and tying operations about every 100 feet.

END OF SECTION

Section 03600

GROUT, NON-SHRINK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section provides requirements for furnishing and placing non-metallic, non-shrink cementitious and epoxy type grouts for leveling column base plates, steel beams bearing on concrete, machinery and equipment, anchoring handrail posts into sleeves embedded into concrete, concrete repairs, and related work.
- B. Section provides requirements for cement-fine aggregate topping for concrete basins.

1.03 REFERENCES

- A. Definition:
 - 1. Non-Shrink Grout: High-strength mortar or grout, which does not shrink in the plastic state, is dimensionally stable in the hardened state, and bonds permanently to a clean metal base plate, anchorage, concrete substrate, and other work.
- B. References:
 - 1. American Concrete institute (ACI):
 - a. 503.2 – Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive.
 - 2. ASTM International (ASTM):
 - a. C109 – Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
 - b. C150 – Specification for Portland Cement
 - c. C157 – Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
 - d. C579 – Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes.
 - e. C827 – Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
 - f. C881 – Specification for Epoxy-Resin-Base Bonding Systems for Concrete
 - g. C1090 – Test method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout
 - h. C1107 – Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
 - 3. Corps of Engineers, (CE):
 - a. CRD-C620 – Standard Method of Sampling Fresh Grout
 - b. CRD-C621 – Specification for Non-Shrink Grout

1.04 SUBMITTALS

- A. Action Submittals:
 - 1. Product Data: Provide manufacturer's product data and installation instructions.
 - 2. Proposed method for keeping existing concrete surfaces wet prior to placing grout.
 - 3. Forming method for fluid grout applications.
 - 4. Curing method for grout.
- B. Informational Submittals:

1. Manufacturer's Instructions.
2. Manufacturer's Training Schedule.
3. Material Certification: provide certificates of compliance or laboratory test reports, which indicate the following:
 - a. Materials used are free from metallic components or corrosion-producing elements.
 - b. Materials meet specified shrinkage and compressive strength requirements.
4. Manufacturer's Certificate of Installation.
5. Statement of Qualifications: Non-shrink grout manufacturer's representative.
6. Test Reports:
 - a. Report for 24-hour evaluation of non-shrink grout.
 - b. Field test reports and laboratory test results for field-drawn samples.

1.05 QUALIFICATIONS

- A. Non-Shrink Grout Manufacturer's Representative: Authorized and trained representative of grout manufacturer. Minimum one-year experience, which has resulted in successful installation of grouts similar to those proposed for Project.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in unopened containers bearing intact manufacturer's labels. Store materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers listed in the following paragraphs.

2.02 MATERIALS

- A. Cementitious Grout: Provide non-shrink, non-metallic, non-corrosive cement-based grout conforming to the following requirements:
 1. Prepackaged natural aggregate grout requiring only the addition of water.
 2. Applicable Standards: ASTM C1107 and CE CRD-C621.
 3. Grout: ASTM 1107, Grade A, B, or C, as appropriate for the conditions.
 4. Height Change at 28 days: ASTM C-1090, 0.1% maximum.
 5. Compressive Strength, ASTM C109 in accordance with the compressive strengths listed in the Non-Shrink Grout Schedule for the application:
 6. Initial Setting Time, After Addition of Water: Approximately one hour at 70oF.
 7. Grout shall not bleed at maximum allowed water.
 8. Available Manufacturers:
 - a. Chemrex, Inc., Shakopee, MN
 - b. Dayton Superior Corp., Miamisburg, OH
 - c. Euclid Chemical Company
 - d. Five Star Products, Inc., Fairfield, CT
 - e. L&M Construction Chemicals, Omaha, NE
 - f. Master Builders, Inc.
 - g. Sika Corporation

- B. Epoxy Grout: Provide non-shrink, non-metallic, non-corrosive epoxy grout conforming to the following requirements:
 - 1. Applicable Standards: ASTM C881 and ACI 503.2.
 - a. Type, Grade, and Class determine by application.
 - 2. Grout shall be manufactured for use in load bearing applications, bonding fresh concrete to hardened concrete.
 - 3. Shrinkage at 28 days: None (0.00 shrinkage) when tested in accordance with ASTM C827, modified procedure, with a minimum effective bearing area (EBA) of 95 percent coverage of the tested base plate.
 - 4. Compressive Strength, Minimum: 10,000 psi at seven days, when tested in accordance with ASTM C579.
 - 5. Initial Setting Time, After Addition of Water: Approximately one hour at 70oF.
- C. Epoxy Adhesive: ASTM C881, Type V, epoxy-based bonding agent.
- D. Portland Cement: ASTM C150.
- E. Pea Gravel: Conforming to ASTM C33, Aggregate Size No. 8, coarse aggregate graded with 100 percent passing a 3/8-inch sieve and 90 percent retained on a No. 4 sieve.
- F. Water: Clean, potable, free of impurities detrimental to grout.
- G. Water-based, high solids content, non-yellowing curing compound: ASTM C 309, Type 1, Class B, and ASTM C 1315, Type 1, Class A.
 - 1. Moisture Loss: 0.40 kg/square meter/72 hours.
 - 2. Capable of moisture retention at manufacturer's specified application rate.
 - 3. Available Products:
 - a. Chemrex, Inc., Shakopee, MN; Masterkure.
 - b. Dayton Superior Corp., Miamisburg, OH; Safe Cure and Seal 30%.
 - c. Euclid Chemical Co., Cleveland, OH; Super Diamond Clear VOX.
 - d. L&M Construction Chemicals, Omaha, NE; L&M Cure R-2
 - e. WR Meadows, Inc., Hampshire, IL; VOCOMP-30.
 - f. Vexcon Chemical, Inc., Philadelphia, PA; Starseal 1315.

2.03 MIXES

- A. Cementitious Grout Mixes:
 - 1. Mix cementitious grout in a mechanical mixer for the specified required time in accordance with the grout manufactures instructions.
 - 2. Use required quantity of water necessary to produce a grout mixture having the desired flow properties; fluid, flowable, or plastic.
 - 3. Select the desired properties for the application as indicated in the Non-Shrink Grout Schedule.
 - 4. For areas over 4-inches in depth and where coarse aggregate will not obstruct passage of grout, the grout may be extended by adding clean pea gravel, if allowed and as recommended by the grout manufacturer. Comply with the grout manufacturer's recommendations for the maximum amount of per gravel to be added.
- B. Epoxy Grout Mixers: Mix in accordance with ACI 503.2 and grout manufacturer's instructions.
- C. Non-Structural Concrete Topping:
 - 1. Design for 3,000 psi at 28 days using pea gravel, 5-inch maximum slump, 0.50 maximum water-cementitious material ratio, and minimum cementitious material content of 470 pounds per cubic yard.
 - 2. For use in adjusting final bottom elevation in clarifiers, thickeners, and related treatment units after the equipment has been installed.

PART 3 EXECUTION

3.01 PREPARATION

- A. Remove all defective concrete, laitance, dirt, oil, grease, and other foreign matter from concrete surfaces by bush-hammer, chipping or other means, until a sound, clean concrete surface is achieved.
- B. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout. Cover concrete areas with protective waterproof covering until ready to receive grout.
- C. Remove foreign matter from steel surfaces to be in contact with grout. Clean contact steel surfaces as necessary by wire brushing and wiping dust clean.
- D. Align, level, and maintain final positioning of all components to be grouted. Coat shims with a thin film of grease or wax to facilitate removal. Provide relief holes to avoid trapping air beneath machinery and equipment base plates and other large base plates.
- E. Saturate all concrete surfaces with clean water for the period of time specified by manufacturer. Remove excess water, leaving none standing. Immediately before starting grouting operations, inspect surfaces to be grouted, removing any foreign matter.

3.02 FORMWORK

- A. Construct leak proof forms around objects to be grouted, anchoring and shoring to withstand grout pressures. Forms to be constructed high enough to provide a "head" of grout where required forcing grout into difficult locations.
- B. Provide enough clearance between formwork and area to be grouted permitting proper placement of grout.

3.03 MIXING

- A. Mixing of grout shall be in accordance with the manufacturer's instructions. Mix using proper mechanical mixers.
- B. Mix grout as close to the work area as possible, transport the mixture quickly and in a manner that does not permit segregation of materials.
- C. After the grout has been mixed, do not add more water for any reason.

3.04 PLACING

- A. Place grout in accordance with manufacturer's instructions and recommendations. Place grout quickly and continuously by the most practical means possible; pouring, pumping or under gravity pressure. Place grout on one side only until grout rises at least one inch above the plate on opposite side.
- B. Follow established concrete procedures and grout manufacturer's instructions for precautions for hot and cold weather concreting.
- C. Final installation shall be a thoroughly compacted and free from air pockets. To facilitate placement, a chain or metal strap may be pulled back and forth under the base plates, forcing grout to flow under the entire area.
- D. Do not vibrate the placed grout mixture or allow it to be placed if the area is being vibrated by nearby equipment.
- E. Allow adequate depth between bottom of base plate and top of concrete base to assure the void can be completely filled with grout.

- F. Neatly trowel edges of grout base, tapered at an angle of 60 degrees when measured from horizontal, or as indicated. Provide dry-pack cementitious grout where additional grout is required for shoulders.
- G. Do not remove leveling shims for at least 48 hours after grout has been placed. After shim removal, fill voids with grout, packing using a suitable tool.
- H. Fill the angular space between handrail posts and sleeves with grout; bevel grout at junction with post preventing water to flow away from post.
- I. Do not use grout, which has begun to set, or if more than one hour has elapsed after initial mixing.
- J. Where necessary to achieve bonding, an epoxy adhesive may be applied to clean, dry substrate surfaces in accordance with applicable requirements of ACI 503.2.

3.05 GROUT TOPPING FOR CONCRETE BASINS

- A. Ensure all adjustments have been made to equipment prior to placement of grout topping.
- B. Prior to placement, perform the following operations:
 - 1. Remove all laitance, debris, and foreign material from the base slab.
 - 2. Use a metal screed or the equipment to check surface elevation ensuring the minimum thickness of grout can be obtained.
 - 3. If there is not sufficient room for grout placement, remove high spots or adjust equipment, or both, to provide required clearance.
 - 4. Thoroughly wet base slab 24-hours prior to start of concrete topping placement. Keep surface damp.
 - 5. Brush in neat cement grout immediately before placement of grout topping.
- C. When recommended by equipment manufacturer, use the basin equipment to screed grout on the basin floor. A representative of the equipment manufacturer is to be present during the screeding operation, unless otherwise approved by ENGINEER. Screed in accordance with equipment manufacturer's instructions.

3.06 CURING

- A. Cure cementitious grout for three days after placing by keeping wet and cover with burlap, clothes, or coating with a concrete membrane forming curing compound.
- B. Epoxy grout shall be cured in accordance with grout manufacturer's instructions.

3.07 FIELD QUALITY CONTROL

- A. Evaluation and Acceptance of Cementitious Non-Shrink Grout.
 - 1. Provide a flow cone and cube molds with restraining caps. Continue tests during operations as demonstrated by grout manufacturer's representative.
 - 2. Perform flow cone and bleed tests, and make three 2-inch by 2-inch cubes for each 25 cubic feet of each type of non-shrink grout used. Use restraining caps for cube molds in accordance with CE CRD-C621.
 - 3. Following properties shall be in compliance with CE CRD-C621:
 - a. Consistency: Grout outside range requirements will be rejected.
 - b. Segregation: Grout, when aggregates separate will be rejected.
 - c. Strength Test Failures: Grout work failing strength tests will be removed and replaced.
 - d. Perform bleeding test demonstrating grout will not bleed.
 - e. Store cubes at 70oF.
 - f. Independent Testing Laboratory shall prepare, store, cure, and test cubes in accordance with CRD-C621.

GROUT, NON-SHRINK

3.08 NON-SHRINK GROUT SCHEDULE

- A. Furnish non-shrink grout for applications for consistency and compressive strengths as listed in the following construction schedule.

Non-Shrink Grout Schedule

Application	Consistency	Flow Conditions	Compressive Strength, psi
Filling tie holes, concrete repairs	Flowable	140 percent	7000
Column base plates	Fluid	20 to 30 seconds	7500
Equipment bases, 25 hp or less	Fluid	20 to 30 seconds	7500
Equipment bases, greater than 25 hp	Fluid	20 to 30 seconds	9000
Base plates and/or soleplates with vibration, thermal movement, etc.	Fluid	20 to 30 seconds	9000

END OF SECTION

Section 05500

METAL FABRICATIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Miscellaneous metal framing and supports.
2. Loose bearing and leveling plates.
3. Miscellaneous steel trim.
4. Metal bollards.

B. Related Sections include the following:

1. Division 5 Section 05511 "Metal Stairs" for metal stairs pan, plate, and grating treads.
2. Division 5 Section 05530 "Gratings" for metal gratings.

1.03 PERFORMANCE REQUIREMENTS

Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Engineering calculation shall be based on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.04 SUBMITTALS

A. Product Data: For each product used on Project.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. 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. Welding certificates: Submit for each product used on the Project.

1.05 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following as applicable:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

1.07 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, which are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Ferrous Metals:
 - 1. Steel Plates, Shapes, and Bars: ASTM A 36.
 - 2. Stainless-Steel Bars and Shapes: ASTM A 276, Type 316 for nonwelded items and Type 316L for welded items..
 - 3. Rolled-Steel Floor Plate: ASTM A 786, rolled from plate complying with ASTM A 36 or ASTM A 283, Grade C or D.
 - 4. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
 - 5. Steel Tubing: ASTM A 500, Grade B, cold-formed steel tubing.
 - 6. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
 - 7. Slotted Channel Framing: Cold-formed metal channels complying with MFMA-3, 1-5/8 by 1-5/8 inches. Channels made from stainless steel complying with ASTM A 653/A 653M, structural steel, Grade 33, with G90 coating; 0.079-inch nominal thickness.
- C. Nonferrous Metals:
 - 1. Aluminum Extrusions: ASTM B 221, alloy 6063-T6.
 - 2. Aluminum-Alloy Rolled Tread Plate: ASTM B 632, alloy 6061-T6.
 - 3. Aluminum Castings: ASTM B 26, Alloy 443.0-F.

2.03 FASTENERS

- A. General: Type 316 stainless-steel fasteners for exterior use, at exterior walls, and inside the fiberglass shelter. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Expansion Anchors: Cast-in-Place Anchors in Concrete: Comply with the requirements of Division 5 Section 05501 "Anchor Bolts, Expansion Anchors and Concrete Inserts.
- C. Cast-in-Place Anchors in Concrete: Comply with the requirements of Division 5 Section 05501 "Anchor Bolts, Expansion Anchors and Concrete Inserts.

2.04 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Compatible with the coating system selected in accordance with Division 9 Section 09910 "Painting and Protective Coatings."
- C. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint for regalvanizing welds in steel.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
- E. Concrete Materials and Properties: Comply with requirements in Division 3 Section 03300 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.05 FABRICATION

- A. General: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
 - 1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
 - 2. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.
 - 3. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
 - 4. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
 - 5. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 24 inches o.c.
- B. Miscellaneous Framing and Supports: Provide steel framing and supports not specified in other Sections as needed to complete the Work. Fabricate units from steel shapes, plates, and bars of welded construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Fabricate steel girders for wood frame construction from continuous steel shapes. Where wood nailers are attached to girders with bolts or lag screws, drill holes at 24 inches o.c.
 - 2. Fabricate steel pipe columns for supporting wood frame construction with steel baseplates and top plates welded to pipe with fillet welds the same size as pipe wall thickness.

2.06 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts.

METAL FABRICATIONS

2.07 MISCELLANEOUS STEEL TRIM

- A. Fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Exterior Miscellaneous Steel Trim: Galvanize where indicated.

2.08 METAL BOLLARDS:

- A. Requirements:
- B. Fabricate from Schedule 80 steel pipe.
- C. Coating: Apply bituminous paint to concealed bottoms, sides, and edge of bollards set in concrete.

2.09 METAL FLOOR PLATE:

- A. Requirements:
 - 1. Fabricate from plate material indicated on the Drawings and thickness indicated below:
 - a. Thickness: 1/4 inch, unless otherwise indicated on Drawings.
 - 2. Provide angle supports of the same material as the plate as indicated.
 - 3. Provide flush bar drop handles for lifting removable sections, one at each end of each section.

2.10 ABRASIVE METAL NOSINGS, TREADS, AND THRESHOLDS.

- A. Cast-Metal Units: Cast aluminum, with an integral abrasive finish.
 - 1. Available Manufacturers:
 - a. American Safety Tread Co., Inc.
 - b. Balco Inc.
 - c. Wooster Products Inc.
 - d. Approved equal.
- B. Extruded Units: Aluminum, with abrasive filler in an epoxy-resin binder.
 - 1. Available Manufacturers:
 - a. American Safety Tread Co., Inc.
 - b. Balco Inc.
 - c. Wooster Products Inc.
 - d. Approved equal.
 - 2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.

2.11 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish metal fabrications after assembly.
- B. Steel and Iron Finishes:
 - 1. Hot-dip galvanize items as indicated to comply with ASTM A 123 or ASTM A 153 as applicable.
 - 2. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, to comply with the coating system selected in accordance with Division 9 Section 09901 "Protective Coatings."

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true.
 - 1. Fit exposed connections accurately together. Weld connections that are not to be left as exposed joints but cannot be shop welded. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication.
 - 2. Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
 - 3. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- B. Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack solidly with nonshrink, nonmetallic grout.
- C. Bollards:
 - 1. Install bollards as shown on the Drawings and the following as applicable:
 - a. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with nonshrink, nonmetallic grout.
 - b. Anchor bollards in place with concrete footings. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
 - 2. If bollard does not have a metal cap, fill bollards solidly with concrete, mounding top surface to shed water.
- D. Touch up surfaces and finishes after erection.
 - 1. Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.
 - 2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

Section 05502

ANCHOR BOLTS, EXPANSION ANCHORS & INSERTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General Conditions with Appendices thereto, Supplementary General Conditions, Special Conditions, other Instructions and Provisions, and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

Provide anchor bolts, expansion anchors and concrete inserts for equipment and metal fabrications as specified or shown on the Plans, including, but not limited to:

1. Metal stairs
2. Hangers and brackets
3. Equipment and piping
4. Bio-scrubber vessels and tanks
5. Grating and floor plate
6. Electrical, Plumbing and HVAC Work
7. Metal and plastic fabrications

B. Related Sections:

Requirements for anchor bolts and fasteners for metal fabrications are described in applicable sections of Division 5 Metals.

1.03 REFERENCES AND DEFINITIONS

A. References:

ASTM International (ASTM):

A 36 – Specification for Carbon Structural Steel

A 193 – Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications

A 194 – Specification for Carbon and Alloy Steel for Bolts for High Pressure or High Temperature, or Both

A 283 – Specification for Low and Intermediate Tensile Strength Carbon Steel Plates

A 307 – Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners

A 320 – Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service

C 881 – Specification for Epoxy-Resin-Base Bonding Systems for concrete

E 488 – Test Method for Strength of Anchors in Concrete and Masonry Units

E 1512 – Test Method for Testing bond Performance of Bonded Anchors

F 436 – Specification for Hardened Steel Washers

F 593 – Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

F 594 – Specification for Stainless Steel Nuts

F 844 - Specification for Washers, Steel, Plain (Flat), Unhardened for General Use

F 1554 – Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

International Code Council (ICC): Evaluation Reports for Concrete and Masonry Anchors.

FM Global (Formerly: FM - Factory Mutual System)

NSF International (NSF)

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- B. Definitions:
 - 1. Exterior Area: Location not protected from the weather by a building or other enclosed structure.
 - 2. Interior Dry Area: Location inside building or structure where floor is not subject to liquid spills or washdown, not where wall or roof slab is common to a water-holding or earth-retaining structure.
 - 3. Interior Wet Area: Location inside building or structure where floor is sloped to floor drains or gutters and is subject to liquid spills or washdown, or where wall, floor, or roof slab is common to a water-holding or earth-retaining structure.
 - 4. Submerged: Location at or below top of wall or embankment of open water-holding structure, such as a basin or channel, or wall, ceiling, or floor surface inside a covered water-holding structure, or exterior below grade wall or roof surface of water-holding structure, open or covered.

1.04 DESIGN REQUIREMENTS

- A. When the size, length or load carrying capacity of an anchor bolt, expansion anchor, or concrete insert is not shown on the Plans, provide the size, length and capacity required to carry the design load times a minimum safety factor of four.
- B. Determine design loads as follows:
 - 1. For equipment anchors, use the design load recommended by the manufacturer and approved by the ENGINEER.
 - 2. For pipe hangers and supports, use one half the total weight of pipe, fittings, valves, accessories and water contained in pipe, between the hanger or support in question and adjacent hangers and supports on both sides.
 - 3. Allowances for vibration are included in the safety factor specified above.

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for products.
- B. Shop Drawings Submittals
Submit the following:
 - 1. Setting drawings and templates for location and installation of anchorage devices.
 - 2. Copies of manufacturer's specifications, materials, load tables, dimension diagrams and installation instructions for anchorage devices.
- C. Samples: Submit representative samples of bolts, anchors and inserts as may be requested for review by the ENGINEER. Review will be for type and finish only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Adhesive anchor installers shall be trained and certified by manufacturer.
- B. Testing Agency Qualifications: Qualified for testing anchors in accordance with ASTM E 488 and E 1512.

PART 2 PRODUCTS

2.01 GENERAL

- A. Bolt, Washers, and Nuts: Use stainless steel, hot-dip galvanized steel, and zinc-plated steel types as indicated in Fastener Schedule at end of this Section.

- B. Unless otherwise indicated, comply with the ASTM requirements in the following table:

Item	ASTM Reference
Stainless Steel:	
Bolts, Threaded Rods, and Anchor Studs	F 593, AISI Type 316, Condition CW
Nuts	F 594, AISI Type 316, Condition CW

2.02 ANCHOR BOLTS AND ANCHOR BOLT SLEEVES

- A. Cast-In-Place Anchor Bolts:
1. Headed type, unless otherwise shown on Drawings.
 2. Material type and protective coating as listed in Fastener Schedule.
- B. Anchor Bolt Sleeves:
1. Plastic:
 - a. Single unit construction with corrugated sleeve.
 - b. Top of sleeve shall be self-threading to provide adjustment of threaded anchor bolt projection.
 - c. Material: High density polyethylene.
 2. Fabricated Steel: ASTM A 36.

2.03 CONCRETE DRILLED ANCHORS

- A. Mechanical Expansion Anchors:
1. Design Requirements: Anchor bolt and sleeve assembly shall have capability to sustain without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E 488.
 2. Material: AISI Type 316 stainless, hot-dip galvanized or zinc-plated steel as listed in Fastener Schedule.
 3. Current evaluation and acceptance reports by ICC or other similar code organization, and listed by UL and FM Global.
 4. Acceptable for use in potable water structures by NSF and local health organizations.
 5. Type:
 6. Self-drilling Anchors; snap-off or flush type, zinc-plated.
 7. Non-drilling Anchors; flush type for use with zinc-plated or stainless steel bolt, or stud type with projecting threaded stud.
 8. Size: As shown on Drawings and required for the concrete strength specified.
 9. Manufacturers. Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ITW Ramset/Red Head, Wood Dale, IL.
 - b. Hilti, Inc., Tulsa, OK
 - c. Powers Rawl, New Rochelle, NY
 - d. Simpson Strong-Tie Co., Inc., Pleasanton, CA
- B. Wedge Anchors:
1. Material: AISI Type 316 stainless, hot-dip galvanized or zinc-plated steel as listed in Fastener Schedule.
 2. Current evaluation and acceptance reports by ICC or other similar code organization, and listed by UL and FM Global.
 3. Manufacturers. Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ITW Ramset/Red Head, Wood Dale, IL.
 - b. Hilti, Inc., Tulsa, OK

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- c. Powers Rawl, New Rochelle, NY
- d. Simpson Strong-Tie Co., Inc., Pleasanton, CA
- C. Adhesive Anchors:
 - 1. General: Consist of all-thread anchor rod, nut, washer, and adhesive material.
 - 2. Threaded rod:
 - a. Material: Unless otherwise specified:
 - 1) ASTM A36 for interior application, unless otherwise specified.
 - 2) ASTM F 593 Stainless steel threaded rod for exterior, interior wet, and submerge applications.
 - 3) ASTM A 193, Grade B7, Type 2 for high strength applications.
 - b. Diameter as shown on the Drawings or as required for the loads and conditions.
 - c. Length as required to provide minimum depth of embedment.
 - d. Clean and free of grease, oil, or other deleterious material.
 - e. For hollow-unit masonry, provide galvanized or stainless steel wire cloth screen tube to fit threaded rod.
 - f. Anchor rods shall have rolled threads.
 - 3. Adhesive:
 - a. Two-component, designed to be used in adverse/thaw environments, with gray color mixing.
 - b. Cure Temperature, Pot Life, and Workability: Compatible for the intended use and environmental conditions.
 - c. Nonsag, with selected viscosity base on installation temperature and overhead application where applicable.
 - d. Meets ASTM C881, Type IV, Grade 3, Class A, B, and C, with the exception of gel time and epoxy content.
 - e. Manufacturers: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) ITW Ramset/Red Head, Wood Dale, IL.
 - 2) Hilti, Inc., Tulsa, OK
 - 3) Powers Rawl, New Rochelle, NY
 - 4) Simpson Strong-Tie Co., Inc., Pleasanton, CA
- D. Concrete Inserts:
 - 1. For piping, grating and floor plate provide malleable iron inserts.
 - 2. Provide those recommended by the manufacturer for the required loading.
 - 3. Finish shall be black.
- E. Powder actuated fasteners and other types of bolts and fasteners not specified herein shall not be used unless approved by ENGINEER.

PART 3 EXECUTION

3.01 CAST-IN-PLACE ANCHOR BOLTS

- A. Accurately locate and hold anchor bolts in place with templates at the time concrete is placed.
- B. Use anchor bolt sleeves for location adjustment and provide two nuts and one washer per bolt of same material as bolt.
- C. Minimum Bolt Size: 1/2-inch diameter by 12 inches long, unless otherwise shown.

3.02 CONCRETE AND MASONRY DRILLED ANCHORS

- A. Begin installation only after concrete or masonry to receive anchors has obtained design strength.
- B. Install in accordance with manufacturer's instructions.

- C. Provide minimum embedment, edge distance, and spacing as follows, unless indicated otherwise by manufacturer's instructions or shown otherwise on Drawings.

Anchor Type	Min. Embedment (bolt diameters)	Min. Edge Distance (bolt diameters)	Min. Spacing (bolt diameters)
Wedge	9	6	12
Expansion and Sleeve	4	6	12
Adhesive	9	9	13.5

- D. Use only drill type, bit type, and diameter recommended by anchor manufacturer. Clean hole of debris and dust with brush and oil-free compressed air.
- E. CONTRACTOR shall accurately locate steel reinforcement by the use of a pachometer or other approved means, prior to drilling the hole. If reinforcing is encountered in drilling holes for mechanical anchors, the hole should be abandoned and a new hole should be drilled.
- F. Mechanical anchors shall be set by applying the manufacturer's recommended torque. Do not exceed maximum torque as specified in manufacturer's instructions.
- G. Adhesive Anchors:
1. Do not install adhesive anchors when temperature is below 40 degree F or above 100 degree F.
 2. Remove any standing water from hole with oil-free compressed air. Inside surface of hole shall be dry.
 3. Do not disturb anchor during recommended curing time.

3.03 FIELD QUALITY CONTROL

Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections on concrete and masonry anchors when indicated on the Drawings.

3.04 MANUFACTURER'S SERVICES

Adhesive Anchors: Conduct site training of installation personnel for proper installation, handling, and storage of adhesive anchor system.

3.05 FASTENER SCHEDULE

Unless otherwise indicated on the Drawings, provide anchor bolts and anchors as follows:

Service Use and Location	Product	Remarks
1. Anchor Bolts Cast into Concrete for Equipment Bases		
Interior Dry Areas	Stainless steel headed anchor bolts, unless otherwise specified with equipment.	Use Anti-seizing Lubricant on all stainless steel threads.
Submerged, Exterior, Interior Wet, and Corrosive Areas	Stainless steel headed anchor bolts with fusion bonded coating, unless otherwise specified with equipment	See Section 09910, Protective Coatings Use Anti-seizing Lubricant on all stainless steel threads.

Continued on the following page.

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Service Use and Location	Product	Remarks
2. Drilled Anchors for Equipment and Components to Cast-in-Place Concrete		
Interior Dry Areas	Adhesive stainless steel anchors	Use Anti-seizing Lubricant on all stainless steel threads.
Submerged, Exterior, Interior Wet, and Corrosive Areas	Adhesive stainless steel anchors	Use Anti-seizing Lubricant on all stainless steel threads.
3. Connections for Structural Steel Framing and Support Components		
Exterior and Interior Wet and Dry Areas	High-strength steel bolted connections	Use hot-dipped galvanized high-strength bolted connections for galvanized steel framing members.
4. Connections of Aluminum Components		
Submerged, Exterior and Interior Wet and Dry Areas	Stainless steel bolted connections, unless otherwise specified with equipment.	Use Anti-seizing Lubricant on all stainless steel threads.

END OF SECTION

Section 05511

METAL STAIRS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Industrial-type stairs with aluminum grating treads.
2. Aluminum tube railings attached to metal stairs.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for metal treads and nosings not installed in metal stairs.
2. Division 5 Section "Pipe and Tube Railings" for pipe and tube railings.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch, whichever is less.

B. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
3. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.

1.04 SUBMITTALS

A. Product Data: For metal stairs.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Provide templates for anchors and bolts specified for installation under other Sections.
2. 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.

METAL STAIRS

- C. Samples for Initial Selection: For products involving selection of color, texture, or design.
- D. Welding certificates.

1.05 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following as applicable:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

1.07 COORDINATION

- A. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36.
- C. Steel Tubing: ASTM A 500 (cold formed).
- D. Rolled-Steel Floor Plate: ASTM A 786, rolled from plate complying with ASTM A 36 or ASTM A 283, Grade C or D.
- E. Wire Rod for Grating Crossbars: ASTM A 510.
- F. Iron Castings: Either gray iron, ASTM A 48, Class 30, or malleable iron, ASTM A 47, unless otherwise indicated.
- G. Galvanized

- H. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011, either commercial steel, Type B, or structural steel, Grade 30.
- I. Expanded Metal, Carbon Steel: ASTM F 1267, Class 1 (uncoated).
- J. Woven-Wire Mesh: Intermediate-crimp, 2-inch woven-wire mesh, made from 0.135-inch nominal diameter wire complying with ASTM A 510.
- K. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

2.03 MISCELLANEOUS MATERIALS

- A. Cast-Metal Abrasive Nosing: Cast gray iron, Class 20, with an integral abrasive finish.
 - 1. Available Manufacturers:
 - a. American Safety Tread Co., Inc.
 - b. Balco Inc.
 - c. Wooster Products Inc.
 - d. Approved equal.
 - 2. Apply bituminous paint to concealed bottoms, sides, and edges of units set into concrete.
- B. Extruded Abrasive Nosing: Extruded-aluminum units with abrasive filler.
 - 1. Available Manufacturers:
 - a. American Safety Tread Co., Inc.
 - b. Balco Inc.
 - c. Wooster Products Inc.
 - d. Approved equal.
 - 2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
- C. Fasteners: Provide 316 SST fasteners.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Concrete Materials and Properties: Comply with requirements in Division 3 Section 03315 "Concrete for Utility Construction" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
- F. Welded Wire Fabric: ASTM A 185, 6 by 6 inches--W1.4 by W1.4, unless otherwise indicated.
- G. Precast Concrete Treads: Comply with requirements in Division 3 Section 03315 "Concrete for Utility Construction" for normal-weight concrete with a minimum 28-day compressive strength of 5000 psi and a total air content of not less than 4 percent or more than 6 percent. Reinforce with galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch- diameter wire.

2.04 FABRICATION

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding, unless otherwise indicated. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. At exposed connections, finish exposed welds smooth and blended.
 - 2. Use connections that maintain structural value of joined pieces.
 - 3. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
 - 4. Form bent-metal corners to smallest radius possible without impairing work.
 - 5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

METAL STAIRS

- B. Stair Framing: Fabricate stringers of aluminum plates or channels. Construct platforms of aluminum plate or channel headers and miscellaneous framing members.
If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
- C. Metal Bar-Grating Stairs: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."
 - 1. Fabricate treads and platforms from aluminum grating with 1-1/4-by-3/16-inch bearing bars at 15/16 inch o.c. and crossbars at 4 inches o.c.
 - 2. Fabricate grating treads with aluminum floor plate nosing and with aluminum angle or aluminum plate carrier at each end for stringer connections. Secure treads to stringers with bolts.
- D. Aluminum Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
 - 1. Configuration: 1-1/2-inch- square top, bottom, and intermediate rails and posts. Space intermediate rails less than 21 inches clear.
 - 2. Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose.
 - 3. Form changes in direction of railings by bending or by inserting prefabricated fittings.
 - 4. Form curves by bending members in jigs to produce uniform curvature without buckling.
 - 5. Close exposed ends of railing members with prefabricated end fittings.
 - 6. Provide wall returns at ends of wall-mounted handrails.
 - 7. Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
 - 8. Connect posts to stair framing by direct welding.

2.05 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish metal stairs after assembly.
- B. Hot-dip galvanize items indicated to be galvanized. Comply with ASTM A 123 or ASTM A 153 as applicable.
- C. Apply coating system in accordance with Division 9 Section 09910 "Painting and Protective Coatings."
- D. Aluminum: Unless otherwise specified, provide an anodized finish, medium satin, etched, Architectural Class 1 (natural) as specified in the NAAMM Manual. Castings may have an A31 Architectural Class II anodic coating.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify field conditions are acceptable and are ready to receive work. Beginning of installation means erector accepts existing conditions.

3.02 INSTALLATION

- A. Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Field Welding: Comply with the following requirements:
 - 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. When required, place and finish concrete fill for treads and platforms to comply with Division 3 Section "Cast-in-Place Concrete."
 - 1. Install abrasive nosings with anchors fully embedded in concrete.
- G. When required, install precast treads with adhesive supplied by manufacturer.
- H. Attach handrails to wall with wall brackets.
 - 1. Use type of bracket with [flange tapped for concealed anchorage to threaded hanger bolt] [predrilled hole for exposed bolt anchorage].

3.03 FIELD CONTROL

- A. Erection Tolerances:
 - 1. Maximum Variation From Plumb: 1/4-inch per 10 feet.
 - 2. Maximum Offset From True Alignment:: 1/4-inch.

3.04 ADJUSTING AND CLEANING:

- 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting.
- 2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

Section 05521

PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General Conditions with Appendices thereto, Supplementary General Conditions, Special Conditions, other Instructions and Provisions, and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Aluminum pipe and tube railings.
- B. Related Sections include the following:
 - 1. Division 5 Section "Metal Stairs" for aluminum tube railings associated with metal stairs.

1.03 PERFORMANCE REQUIREMENTS

- A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
 - 2. Stainless Steel: 60 percent of minimum yield strength.
 - 3. Steel: 72 percent of minimum yield strength.
- B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails:
 - a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
- C. Top Rails of Guards:
 - 1. Uniform load of 50 lbf/ ft. applied in any direction.
 - 2. Concentrated load of 200 lbf applied in any direction.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
- D. Infill of Guards:
 - 1. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - 2. Infill load and other loads need not be assumed to act concurrently.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.04 SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. 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. Samples for Initial Selection: For products involving selection of color, texture, or design.

- D. Welding certificates.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.06 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

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. Aluminum Pipe and Tube Railings:
 - a. Blum, Julius & Co., Inc.
 - b. Braun, J. G., Company; a division of the Wagner Companies.
 - c. Tubular Specialties Manufacturing, Inc.
 - d. Wagner, R & B, Inc.; a division of the Wagner Companies.

2.02 METALS

- A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.
- B. Aluminum: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
 - 1. Extruded Bars and Tubing: ASTM B 221, Alloy 6063-T5/T52.
 - 2. Extruded Structural Pipe and Round Tubing: ASTM B 429, Alloy 6063-T6.
 - 3. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.
 - 4. Plate and Sheet: ASTM B 209, Alloy 6061-T6.
 - 5. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.
 - 6. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.
 - 7. Woven-Wire Mesh: Intermediate-crimp, 2-inch woven-wire mesh, made from 0.162-inch nominal diameter wire complying with ASTM B 211, Alloy 6061-T94.
- C. Steel and Iron:
 - 1. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
 - 2. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 3. Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 4. Castings: Either gray or malleable iron, unless otherwise indicated.
 - a. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

- b. Malleable Iron: ASTM A 47/A 47M.
- 5. Expanded Metal: ASTM F 1267, Type II (expanded and flattened)], Class 1 (uncoated).
- 6. Woven-Wire Mesh: Intermediate-crimp, 2-inch woven-wire mesh, made from 0.135-inch nominal diameter wire complying with ASTM A 510.

2.03 MISCELLANEOUS MATERIALS

- A. Fasteners: Provide concealed fasteners, unless unavoidable or standard for railings indicated.
 - 1. Aluminum Railings: Type 316 stainless-steel fasteners.
 - 2. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
- B. Anchors: Provide cast-in-place anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488.
- C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- D. Shop Primer for Steel: Primer shall be coating system selected in accordance with Division 9 Section 09910 "Painting and Protective Systems"
- E. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer compatible with finish paint systems indicated, and complying with SSPC-Paint 5.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Grout and Anchoring Cement: Factory-packaged, nonshrink, nonmetallic grout complying with ASTM C 1107; or water-resistant, nonshrink anchoring cement; recommended by manufacturer for interior and exterior use.

2.04 FABRICATION

- A. General: Fabricate railings to comply with design, dimensions, and details indicated, but not less than that required supporting structural loads.
- B. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
- C. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds, using manufacturer's standard system of sleeve and socket fittings.
- D. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings.
- E. Form changes in direction by bending or by inserting prefabricated elbow fittings.
- F. Form curves by bending in jigs to produce uniform curvature; maintain cross section of member throughout bend without cracking or otherwise deforming exposed surfaces.
- G. Close exposed ends of railing members with prefabricated end fittings.
- H. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
 - I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
- J. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into 1-by-1/2-by-1/8-inch metal channel frames.

2.05 FINISHES

- A. Aluminum:
 - 1. Mechanical Finish: AA-M12 (Mechanical Finish: nonspecular as fabricated).
 - 2. Class I, Color Anodic Finish: AA-M12C22A42/A44 complying with AAMA 611.

- B. Steel and Iron:
 - 1. Galvanized Railings: Hot-dip galvanize indicated railings, after fabrication, to comply with ASTM A 123. Provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
 - 2. Shop-Primed Galvanized Railings: After galvanizing, clean railings, treat with metallic-phosphate process, and apply primer to comply with SSPC-PA 1.
 - 3. Shop-Primed Steel Finish: Primer shall be coating system selected in accordance with Division 9 Section 09910 "Painting and Protective Systems"

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation.
 - 1. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 2. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. When aluminum railings are specified, coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Anchor posts in concrete by inserting into preset steel pipe sleeves or formed or core-drilled holes and grouting annular space as indicated on drawings.
- D. When indicated on the Drawings, anchor posts to metal surfaces with oval flanges.
- E. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.
- F. Attach handrails to wall with wall brackets.

3.02 ADJUSTING AND CLEANING:

- 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting.
- 2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

Section 05530

GRATINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
1. Metal bar gratings.
 2. Expanded-metal gratings.
 3. Extruded-aluminum plank gratings.
 4. Metal frames and supports for gratings.
- B. Related Sections include the following:
1. Division 5 Section 05511 "Metal Stairs" for grating treads and landings of aluminum-framed stairs.
 2. Division 5 Section 05500 "Metal Fabrications" for fabricated metal structures.
 3. Division 5 Section 05521 "Pipe and Tube Railings" for stair and platform railings.

1.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Gratings: Provide gratings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Floors: Uniform load of 125 lbf/sq. ft. or concentrated load of 3000 lbf, whichever produces the greater stress.
 2. Walkways and Elevated Platforms Other Than Exits: Uniform load of 75 lbf/sq. ft..
 3. Walkways and Elevated Platforms Used as Exits: Uniform load of 100 lbf/sq. ft..
 4. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of 250 lbf/sq. ft. or concentrated load of 8000 lbf, whichever produces the greater stress.
 5. Limit deflection to 1/360 or 1/4 inch, whichever is less.

1.04 SUBMITTALS

- A. Product Data: For the following:
1. Extruded-aluminum plank gratings.
 2. Clips and anchorage devices for gratings.
 3. Paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Provide templates for anchors and bolts specified for installation under other Sections.
 2. 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. Welding Certificates.

1.05 QUALITY ASSURANCE

- A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual" and NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual."
- B. Welding: Qualify procedures and personnel according to the following applicable standards:
1. AWS D1.1, "Structural Welding Code--Steel."

GRATINGS

2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.06 COORDINATION

- A. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers listed in the paragraphs below.
- B. Manufacturers:
 1. Metal Bar Gratings:
 - a. Alabama Metal Industries Corporation.
 - b. All American Grating, Inc.
 - c. IKG Industries; a Harsco Company.

2.02 METALS

- A. Ferrous Metals:
 1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 2. Wire Rod for Grating Crossbars: ASTM A 510.
 3. Uncoated Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30.
 4. Galvanized Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33, with G90 coating.
- B. Aluminum:
 1. Extruded Bars and Shapes: ASTM B 221, Alloy 6061-T6 or 6063-T6, for bearing bars of gratings and shapes; Alloy 6061-T1, for grating crossbars.
- C. Stainless Steel:
 1. Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
 2. Bars and Shapes: ASTM A 276, Type 304.

2.03 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Anchors: Provide anchors with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.04 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2.05 FABRICATION

- A. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- B. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- C. Fit exposed connections accurately together to form hairline joints.
- D. Fabricate toeplates for attaching in the field.

2.06 METAL BAR GRATINGS

- A. Welded Steel Grating:
 - 1. Bearing Bar Spacing: 11/16 inch o.c.
 - 2. Bearing Bar Depth: As required to comply with structural performance requirements.
 - 3. Bearing Bar Thickness: 3/16 inch.
 - 4. Crossbar Spacing: 4 inches o.c.
 - 5. Traffic Surface: Plain.
 - 6. Steel Finish: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. of coated surface.
- B. Pressure-Locked, I-Bar Aluminum Grating:
 - 1. Bearing Bar Spacing: 11/16 inch o.c.
 - 2. Bearing Bar Depth: As required to comply with structural performance requirements.
 - 3. Bearing Bar Flange Width: 1/4 inch.
 - 4. Crossbar Spacing: 2 inches o.c.
 - 5. Traffic Surface: Plain.
- C. Removable Grating Sections: When indicated on Drawings, fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
- D. Fabricate cutouts in grating sections for penetrations indicated. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- E. Do not notch bearing bars at supports to maintain elevation.

2.07 GRATING FRAMES AND SUPPORTS

- A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 - 1. Unless otherwise indicated, fabricate from same basic metal as gratings.
 - 2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.
- B. Galvanize steel frames and supports in the following locations:
 - 1. Exterior.
 - 2. Interior, where indicated.

2.08 FINISHES

- A. Finish gratings, frames, and supports after assembly.

GRATINGS

- B. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with ASTM A 123/A 123M.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. Apply shop primer to uncoated surfaces except those with galvanized finishes and those to be embedded in concrete or masonry. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- B. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded. Do not weld, cut, or abrade the surfaces of units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Attach toeplates to gratings by welding at locations indicated.
- D. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- E. Metal Bar Gratings: Comply with recommendations of referenced metal bar grating standards, including installation clearances and standard anchoring details.
 - 1. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
 - 2. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.
 - 3. Comply with manufacturer's written instructions for size and spacing of welds.
- F. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
- G. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

Section 06600

**FIBERGLASS REINFORCED PLASTIC GRATING
AND STRUCTURAL FABRICATIONS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes fiberglass reinforced plastic (FRP):
 - 1. Grating
 - 2. Structural Fabrications
- B. Scope of Work: The CONTRACTOR shall furnish all labor, materials, equipment, and incidentals as required to properly install fiberglass reinforced plastic (FRP) Products specified herein.
- C. Related Sections:

Division 5 Section 05501 "Anchor Bolts, Expansion Anchors and Concrete Inserts."

1.03 REFERENCES

- A. ASTM International, Inc. (ASTM):
 - 1. D 635 - Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
 - 2. D 3647 - Practice for Classifying Reinforced Plastic Pultruded Shapes According to Composition
 - 3. D 3917 - Specification for Dimensional Tolerance of Thermosetting Glass-Reinforced Plastic Pultruded Shapes
 - 4. D 4385 - Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products
 - 5. E 84 - Surface Burning Characteristics of Building Materials
 - 6. F 1092 - Specification for Fiberglass (GRP) Pultruded Open-Weather Storm and Guard, Square Railing Systems
- B. Occupational Safety and Health Act (OSHA):

29CFR 19.10 Code of Federal Regulations
- C. Underwriters Laboratories, Inc. (UL):

94 - Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

1.04 PERFORMANCE REQUIREMENTS

- A. Design Requirements:
 - 1. Environmental Conditions: Fiberglass fabrications will be exposed to severe environmental conditions including temperatures to 120°F with 100 percent humidity and hydrogen sulfide gases. All fiberglass components shall have UV inhibitors.
 - 2. Structural Performance: FRP products shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - a. OSHA -29 CFR as it pertains to worker safety and walking-working surfaces for platforms.

Odor Control Improvements for 11th St Bio-Scrubber Facility

FRP GRATING AND STRUCTURAL FABRICATIONS WBS No. R-000020-0010-3

- b. Design all grating support system components based on the load and deflection criteria specified herein.
- c. Design components to support water lines, electrical conduits, control panels, light posts and other items shown on the Plans.
- d. FRP Grating: Designed for applicable dead load plus a walkway live load of 100 lbs per square foot Uniform Load. Deflection shall not exceed 1/4-inch.
- e. FRP Structural Shapes: Designed into structures, supporting all applicable loads. Deflection shall not exceed L/180.
- f. FRP Grating and Stair Treads: Designed to support a uniform load of 100 pounds per square foot with maximum deflection of L/180, but not over 1/4-inch. Provide extra stiffness around openings.
- g. ADA Compliant Grating: Provide maximum gap between bars of 1/2-inch, designed for 200 lbs per square foot live load with maximum deflection of 1/4-inch.

1.05 **SUBMITTALS**

- A. Product Data: For each type of product indicated.
 - 1. Catalog information and catalog cuts showing materials, design tasks, and showing load, span, and deflection; include manufacturer's specifications.
 - 2. Resin material data, safety sheet, and chemical resistance charts.
 - 3. Color selection chart or samples.
 - 4. Information regarding each type of grating and handrail connection.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Show all FRP materials as required and include all dimensions, connections, fasteners, tolerances, assembly and installation details as required.
- C. Informational Submittals:
 - 1. Manufactures installation instructions.
 - 2. Handling and storage requirements.
 - 3. Qualification Data: For qualified manufacturer.
 - 4. Certificate of Compliance: For each type of product proposed from manufacturer.
 - 5. Product Test Reports: Based on evaluation of comprehensive tests performed by an independent laboratory, dated within two years of submittal, of a fire retardant test report on type of grating proposed.
 - 6. Field quality-control reports.
 - 7. Warranty: Sample of special warranty.

1.06 **QUALITY ASSURANCE**

- A. Manufacturer Qualifications:
 - 1. All items to be provided under this Section shall be furnished only by manufacturers having a minimum of ten (10) years of experience in the design and manufacture of similar products and systems.
 - 2. Additionally, if requested, a record of at least five (5) previous, separate, similar successful installations in the last five (5) years shall be provided.
 - 3. Manufacturer shall be certified to the ISO 9001-2000 standard.
- B. The Installing Contractor shall; assure that all field dimensions are taken accurately and communicated properly to the FRP Fabricator, that other trades will not affect a proper installation of the FRP, and that all manufacturer's instruction and recommendations are followed.
- C. Surface-Burning Characteristics:
 - 1. As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.

2. Gratings shall also have tested burn time of less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D635.
- 1.07 PROJECT CONDITIONS
- Field Measurements: Verify actual locations of walls and other construction contiguous with FRP fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
- A. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - B. Provide allowance for trimming and fitting at site.
- 1.08 COORDINATION
- Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, which are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- 1.09 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, handle and store pumping system components in accordance with manufacturer's written instructions and the requirements of Division 1 Section 01600 "Product Requirements."
 - B. Delivery of Materials:
 1. Ship FRP items factory assemble as practical, with ladders fully shop-fabricated and assembled.
 2. Package and clearly tag parts and assemblies that are of necessity shipped unassembled in a manner that will protect the materials from damage, and facilitate identification and final assembly in the field.
 - C. Storage of Products:
 1. All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Store adhesives, resins, and their catalysts and hardeners in dry indoor storage facilities between 70°F and 85°F.
 2. If FRP materials are not to be installed immediately, then store to prevent twisting, bending, breaking, or damage of any kind. Keep material covered to prevent unnecessary exposure to UV.
- 1.10 WARRANTY
- Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace FRP grating and structural fabrications that fail(s) in materials or workmanship within specified warranty period.
Warranty Period: Three (3) years from date of Substantial Completion.
- PART 2 PRODUCTS
- 2.01 MANUFACTURERS
- A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. American Grating, LLC
 2. Morrison Molded Fiberglass Company (MMFG).
 3. Fibergrate Composite Structures, Inc.

- 4. International Grating, Inc.
- 5. Seasafe, Inc.
- 6. Strongwell.

2.02 GENERAL REQUIREMENTS

- B. All FRP items furnished under this Section shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.
- C. FRP items shall be constructed of strand roving, transverse mat, and a synthetic surface veil, including ultraviolet light inhibitors.
- D. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, and free of voids without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure to corrosives, wear or weathering.
- E. All FRP products shall be flame retardant per ASTM E-84 Class 1 Flame Spread of 25 or less. Gratings shall also have tested burn time of less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D635.

2.03 MATERIALS

- A. Description:
 - 1. FRP structural shapes and systems shall be a composite of glass reinforcements and resin mixture of approximately 45 percent resin to glass ratio, or as required achieving desired properties, manufactured by the pultrusion process, unless otherwise noted, and free of visual defects. Dimensional tolerances shall conform to ASTM D 3917.
 - 2. Fittings shall be made from solid blocks derived from pultruded components. The grating shall be pultruded fiberglass.
- B. Resins: Premium grade, chemical resistant, thermosetting vinyl ester containing a UV inhibitor and a flame retardant. Provide synthetic surface veil and polyurethane coating protection system on all components.
- C. Fiberglass reinforcements shall be Type E glass unless noted otherwise herein in continuous glass fiber strand rovings, continuous glass strand mats, and surface mats which will produce a resin rich surface for maximum chemical resistance. Assembled grating panels shall have a permanently bonded grit, baked epoxy, anti-skid surface.
- D. Provide smooth surfaces with no exposed glass fibers and free of cracks, rips, and blisters. Manufacture pultruded sections with a colored resin so that the color is throughout the section. Use one color for all portions of the system. Coat all cut ends with a compatible resin or a polyurethane coating in accordance with manufacturer's recommendations.
- E. All anchors, fasteners and hardware shall be Type 316 stainless steel. All grated and walkway surfaces shall have a non-skid grit top surface using course epoxy grit.
- F. Products shall have the following minimum structural properties:

Property	Test Method ASTM	Longitudinal Direction	Transverse Direction
Tensile Stress, psi	D-638	30,000	7,000
Tensile Modules, psi	D-638	2.5 x 10 ⁶	0.8 x 10 ⁶
Compressive Stress, psi	D-695	30,000	15,000
Compressive Modulus, psi	D-695	2.5 x 10 ⁶	1.0 x 10 ⁶
Flexural Stress, psi	D-790	30,000	10,000
Flexural Modulus, psi	D-790	1.8 x 10 ⁶	0.8 x 10 ⁶
Modules of Elasticity, psi	Full Section	2.8 x 10 ⁶	

2.04 GRATING

A. General:

1. Grating may be either molded sheets or fabricated of pultruded systems.
2. Assembled using a locking cross-rod design that makes a permanent connection between the cross-rod and bearing bar, and shall completely bonded into a one-piece panel.

B. Pultruded Grating:

1. Pultruded type, I-Bar shaped according to ASTM 3647, Type GCOF, pultruded with ASTM D 3917 dimensional tolerances and defects not exceeding requirements of ASTM D 4385, Level II.
2. Grating sized by the manufacturer, with bearing bar spacing not to exceed 1-inch, a maximum 50 percent open area, and cross tie spacing not to exceed 6 inches, unless permitted by the ENGINEER.
3. Minimum depth 1-1/2 inch.

C. Molded Grating: Fabricated by interweaving continuous glass filaments in both directions, perpendicular to each other and impregnating them with a thermosetting resin. Provide 1-1/2 inch square by 1-1/2 inch or 1-inch thick grid pattern. Minimum depth 1-1/2 inch.

D. Provide 1-1/2-inch minimum bearing surface, with a minimum bearing of 1-inch after maximum displacements to restraints. Anchors shall be spaced at a maximum of 18 inches o.c. on each support. Grating shall have a maximum glass content of 70 percent.

1. Color: Gray.
2. Grating and Stair Treads shall be made from pultruded bearing bars and cross rods.
3. Grating shall have a slip resistant epoxy grit surface.
4. Grating clips shall be Type 316 stainless steel. Minimum of 4 clips per piece.

E. Bolts and Connectors:

1. Type 316 stainless steel.
2. Size and strength to meet UBC requirements.

2.05 STRUCTURAL COMPONENTS

A. Provide all necessary beam cross-members, connection angles, fasteners and mounting brackets, designed and sized by manufacturer. Structural shapes shall be fabricated with good workmanship, closely fitted joints, and finished true to line and in accurate position to permit installation and proper joining of parts in the field.

1. Minimum Thickness:
 - a. Primary structural components (main beams) shall be 3/8-inch.
 - b. All other components shall be 1/4-inch.
2. Field verify dimensions and arrangement prior to fabrication.
3. Use Type 316 stainless steel bolts and washers.
4. All joint surfaces to be bonded shall be abraded to remove surface gloss and be free of burrs or other foreign materials that would prevent proper adhesion.
5. Use high-strength epoxy adhesives designed for FRP use and mechanical fasteners.
6. All pieces to have easily identified part numbers or piece marks.
7. Shop assemble pieces into the largest practical assembly suitable for shipping.

B. Deflection and Safety Factors:

1. Deflection Criteria: Not to exceed L/360.
2. Safety Factors: Minimum ratios of ultimate stress to allowable static service stress:
 - a. Flexural Members: 2.5.
 - b. Compression Members: 3.0.
 - c. Shear: 3.0.
 - d. Connections: 4.0.

3. Minimum design safety factors for dynamic or impact loads shall be twice the values for static service loads.

C. Loads:

1. 100 lbs per square foot uniform live load over platform.
2. Static and dynamic loads for equipment shown.

2.06 LADDERS AND CAGES

A. Ladders:

1. Ladder Rails: 2 x 2 x ¼ square tube; ladder rungs 1 inch diameter solid round.
2. Ladder Rungs:
 - a. Penetrate inside wall of ladder rail tube, countersunk into outside wall of ladder rail tube, providing support for the ladder rung in 4 places.
 - b. This connection is to be fully bonded and with epoxy adhesives and pinned to prevent rung rotation.
 - c. Provide slip-resistant quartz epoxy grit surface on ladder rungs.
3. Ladder Stand-off Brackets: FRP and installed on 6 feet centers maximum.
4. Ladder Base Mount Brackets: FRP construction with bolts of Type 316 stainless steel.
5. Color: Safety yellow.

B. Ladder Cages:

1. Fabricated from FRP Hoops and Straps.
2. FRP Hoops are to be 3 x ¼ preformed FRP. Hoop spacing shall be a max. of 4'-0 on center.
3. FRP Straps are to be 2 x ¼ FRP and are to be spaced at 9" on center.
4. Hoops and Straps are to be bonded with epoxy adhesives and riveted with Type 316 stainless steel rivets.

PART 3 EXECUTION

3.01 EXAMINATION

Verify field conditions are acceptable and are ready to receive work. Beginning of installation means erector accepts existing conditions.

3.02 INSTALLATION

- A. Install all fiberglass components in accordance with the manufacturer's instructions, shop drawing, Drawings and Division 1 Section 01700 "Execution Requirements." All items shall be shop fabricated to the required dimensions and tolerances. Joints to be completed in the field shall be prepared in the factory with correct bevels, and supplied with kits and instructions for completing joints. All cut or machined edges shall be ground smooth and sealed with a compatible bonding resin. Provide and install necessary internal and external joint reinforcements, connections and anchors.
- B. Components shall be installed accurately to alignments and elevations shown with bridge and handrails level, and handrail posts plumb, to within 1/4-inch. Anchor the posts securely as recommended by the fiberglass bridge manufacturer. Install the existing or replacement water lines, conduits, light posts, control panels and other items as shown on the drawings.
- C. Erect floor gratings in place on supporting members with full, uniform bearing on supports. Wedges or shimming devices will not be permitted. Lock grating panels securely in place with removable hold-down fasteners. Not more than 1/4-inch clearance shall exist between grating sections or grating frames. Each section shall be readily removable, except as indicated on drawings. Adjacent sections shall fit together with transverse members forming uninterrupted straight line.

- D. Provide openings and holes as required. Provide openings in gratings indicated for protrusions as required for installing piping, wiring, and equipment. End cuts shall be coated with resin per the manufacturer's recommendations. Gratings which fit around protrusions shall be discontinuous at centerline of opening so each section of grating is readily removable. Gratings shall be fabricated free from warps, twists, or other defects which affect appearance and serviceability. No section of grating shall exceed 125 pounds.
- E. All fiberglass shall be cleaned of foreign material in accordance with manufacturer's instructions. Materials containing defects, such as nicks, gouges, blisters, sharp projections, delaminations or exposed fibers shall not be accepted until repaired or replaced as directed by ENGINEER and OWNER.

END OF SECTION

Section 09901S

PROTECTIVE COATINGS

The following supplements modify Section 09901 – Protective Coating. Where a portion of the Specification is modified or deleted by this Supplementary Specification, the unaltered portions of the Specification shall remain in effect.

2.03 SUBMERGED AND SEVERE SERVICE COATINGS SYSTEMS: Add the following Paragraph 2.03 J:

- J. System 108 - 100% Solids, Isocyanate-Free, Solvent-Free, High Build Epoxy Coating for Wastewater applications only, to be spray applied in one or more coats to all interior surfaces of exposed concrete above the spring line or as otherwise detailed.
1. Product Characteristics:
 - a. Product: 100% solids, solvent-free high-build epoxy system
 - b. Product Type: amine cured epoxy
 - c. VOC Content (ASTM D2584): 0%
 - d. Compressive Strength, psi (ASTM D695): 10,500 (minimum)
 - e. Tensile Strength, psi (ASTM D638): 4,500 (minimum)
 - f. Flexural Strength, psi (ASTM D790): 7,500 (minimum)
 - g. Adhesion to Concrete, psi/mode of failure (ASTM D4541/7234): 350 psi (minimum)/with substrate (concrete) failure
 - h. Chemical Resistance, pH \geq 0.5 (ASTM G20): 60% Sulfuric Acid
 2. In all cases the coating product(s) shall be applied to a minimum dry film thickness of 80 mils to surface profiles of CSP-4 to CSP-5 or 125 mils minimum DFT to surface profiles of CSP-6 or greater.
 3. For resistance to ground water head pressure the coating shall be a minimum of 80 mils for depths up to 15' and 125 mils minimum for depths from 15' to 80'. For depths greater than 80' consult the coating manufacturer for recommendations.
 4. Subsequent top-coating or additional coats of the coating product(s) shall occur within the product recoat window or 24 hours whichever is less. Additional surface preparation procedures will be required if this recoat window is exceeded.

END OF SUPPLEMENT

Approved by:



Ebi Nassiri, P.E.
Assistant Director,
Wastewater Engineering Section,
Engineering and Construction Division



Date

Section 11005

COMMON MOTOR REQUIREMENTS FOR EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors, 250 Hp and smaller, 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.

1.03 REFERENCES

- A. Division 11017 Section 11006 "Common Requirements for Chemical Feed Equipment Systems".
- B. Division 11 Section 11264 "Biological Tower-Type Odor Control System"..

1.04 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.
- B. Unit Responsibility: Motors shall be furnished under other sections as a part of the driven equipment. The CONTRACTOR is responsible for all coordination between the various components, as well as for the warranty.

1.05 SUBMITTALS

- A. Shop Drawings: Include the following:
 - 1. Manufacturer.
 - 2. Rated full load horsepower.
 - 3. Rated volts.
 - 4. Number of phases.
 - 5. Frequency in hertz.
 - 6. Locked rotor amperes (LRA) at rated voltage or NEMA code letter.
 - 7. NEMA design letter.
 - 8. Bearing Type.
 - 9. Service Factor.
 - 10. Nominal speed at full load.
 - 11. Full Load Amperes (FLA)
 - 12. Efficiency at 1/2, 3/4 and full load.
 - 13. Power factor at no load, 1/2, 3/4 and full load.
 - 14. NEMA insulation system classification. For motors required to install outdoors, include information showing compliance with the intent of paragraph 1.4.B.
- B. Integral Horsepower Motors 40HP and Larger: In addition to the information listed above, include:

COMMON MOTOR REQUIREMENTS FOR EQUIPMENT WBS No. R-000020-0010-3

1. No load amperes.
 2. Safe stall time.
 3. Motor manufacturer's recommended maximum power factor correction capacitor kva that can safely be switched with the motor.
 4. Expected value of corrected power factor at no load, 1/2, 3/4 and full load.
 5. Maximum guaranteed slip at full load.
 6. Motor damaged curves for motors larger than 100HP.
- C. Include the motor data sheet at the end of this section in submittal.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. General Electric: "Severe-Duty" Type
 2. Westinghouse: "Mill and Chemical"
 3. Reliance: "Duty Marker"
 4. Baldor: "Chemical Duty"
 5. Siemens: "Severe-duty"

2.02 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules, Drawings or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.03 RATING

- A. Speed and Size:
1. Speed and horsepower sizes are specified in the driven equipment specification sections or are indicated on the Drawings.
 2. Furnish motors sufficiently sized for the particular application and with full-load rating not less than required by the driven equipment at specified capacity.
 3. Size motors so as not to overload at any point throughout the normal operating range.
- B. Voltage:
1. Fractional Horsepower through 1/2 horsepower, single phase: 120 volts.
 2. Larger than 1/2 horsepower, three phase - 480 volts, unless otherwise indicated in the drive equipment specification sections or as indicated on the Drawings.

2.04 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.

2.05 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: Separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings:
 - 1. Motors Smaller than 1/6 Horsepower: Motor manufacturer's standard bearing is acceptable.
 - 2. Motors 1/6 Horsepower and Larger: Supply these motors with grease-lubricated antifriction ball bearings conservatively rated for 100,000 hours of continuous operation under the total radial and thrust loads produced by the actual combination of motor-driven equipment. Provide each motor with suitable lubrication fittings and pressure relief devices.
 - 3. Oil Lubricated: If the driven equipment section specified oil-lubricated bearings for motors, include a suitable sight gauge on each bearing with maximum and minimum levels clearly indicated.
- G. Temperature Rise: Class B.
- H. Insulation: Class F insulation with temperature rise of a Class B system or better, meeting the requirements of NEMA MG 1 and made of non-hygroscopic materials. The insulation shall be manufacturer's premium grade, resistant to attack by moisture, acids, alkalis, and mechanical or thermal shock for 480 volt motors. All insulated winding conductors shall be copper.
- I. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material:
 - 1. Use enclosure type as follows:
 - a. Indoors: Totally enclosed, fan cooled (TEFC).
 - b. Outdoors: Totally enclosed, fan cooled (TEFC), weatherproof.
 - c. Division 1, Class 2 Areas: Provide motors totally enclosed, fan cooled, explosion proof (TEFC-XP).
 - 2. TEFC motors shall have a steel or cast iron frame, cast iron end brackets, cast iron conduit box, tapped drain holes (erosion resistant plug for frames 286T and smaller and automatic breaker/drain devices for frame 324T and larger), and upgraded insulation by additional dips and baked to increase moisture resistance.

2.06 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:
 - 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.

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- 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.
- 2.07 NAMEPLATES
- A. Main Nameplate: Provide each motor with a stainless steel name-plate meeting the requirements of NEMA MG 1, and the National Electrical Code.
 - B. Heater Nameplate: When space heaters are furnished, include voltage and wattage on a suitable nameplate.
 - C. Bearings Nameplate: When bearings are oil lubricated, include oil type information on a suitable nameplate. Also, indicate bearing data if nonstandard.
 - D. Attachment: Attach the nameplates to the motor with stainless steel fastening pins or screws.
- 2.08 CONDUIT BOX
- A. Provide each motor not supplied with a cord and plug with a conduit box amply dimensioned for the motor lead terminations. Include a grounding lug on motors 1/6 horsepower and larger. Supply a gasket suitable for the motor enclosure type and application.
- 2.09 SPACE HEATERS
- A. Provide space heaters in all motors.
 - B. Use heaters hermetically sealed in stainless steel or equivalent corrosion-resistant sheaths.
 - C. Rate heaters 115 volts, 60 hertz.
 - D. Braze heat-resistant insulated leads to the heater or supply heater with brazed leads and extend to the conduit box.
 - E. Size heaters according to the horsepower size as follows:
 - 1. 3/4 - 50 horsepower – 100 watts
 - 2. 60-125 horsepower – 150 watts
 - 3. 150-200 horsepower – 200 watts
- 2.10 MONITORING DEVICES
- A. All motors 20 HP and above and motors driven by variable frequency drives shall be equipped with thermistors.
- 2.11 GROUNDING CONNECTIONS
- A. Ground provisions shall be furnished per NEMA M91.
 - B. For motors less than 10HP, each motor shall be furnished with provision for attaching a ground connection to the motor frame inside the motor terminal housing.
- 2.12 LEADS
- A. For motor leads, use not less than ASTM B 173, Class G, stranded copper conductors with insulation the same as or better than specified in the preceding Motor Insulation paragraph.
 - B. Provide permanent identification numbers on leads according to NEMA MG 1-2.02.
 - C. Use crimp-on, solderless tinned copper terminals on leads and place heat-shrink insulation sleeves or covers between leads and terminals.

2.13 ADDITIONAL REQUIREMENTS FOR VERTICAL MOTORS

- A. Solid shaft vertical motors are acceptable for all applications except when the connection to the driven equipment consists of sectional driven shaft which may unscrew and lengthen with direction reversal.
- B. Hollow-shaft vertical motors are acceptable for all applications when the thrust is in the direction to engage the coupling.
- C. Hollow-shaft vertical motors coupled to a sectional drive shaft with screwed joints shall have special couplings described as follows:
 - 1. Provide motors, except the explosion-proof type, with self-releasing couplings designed to disconnect motor from driven equipment and permit lengthening of drive shaft upon reversal of rotation.
 - 2. Provide explosion-proof motors with non-reversing couplings of spark-resisting construction, designed to prevent reverse rotation.
- D. Design vertical motor thrust bearings conservatively to carry maximum axial thrusts (up and down) imposed by driven equipment.
- E. Vertical motors shall have grease or oil-lubricated bearings at both top and bottom.
- F. Vertical motor bases shall be NEMA Type P.
- G. Provide hollow shaft vertical motors with a positive, non-reversing, corrosion-resistant (anti-ratchet) mechanism.
- H. Provide vertical motors with fan-end splash shields.

2.14 POWER FACTOR CORRECTION CAPACITORS

- A. Linear Loads
 - 1. All single speed motors over 5 horsepower (from variable frequency drives), if indicated on the Drawings, shall be provided with a heavy duty industrial type power factor correction capacitor selected, recommended and furnished by the motor manufacturer to raise the motor power factor to approximately 95 percent. For non-explosion-proof motors, the capacitor shall be mounted on the equipment base plate adjacent to the motor and shall be connected to the motor junction box with liquid tight flexible conduit. For explosion-proof motors, the capacitors shall be wall mounted in a non-hazardous area.
 - 2. Capacitors shall be dry film or liquid insulated and shall be hermetically sealed in steel enclosures.
 - 3. Each capacitor unit shall be furnished with three high interrupting capacity current limiting fuses. Fuses shall be equipped with "blown-fuse" indicators.
 - 4. Capacitor enclosures shall be suitable for conduit connection. Covers shall be gasketed, bolt-on type.
 - 5. Capacitors shall be UL listed.
 - 6. Capacitors shall be by General Electric Co.; Square D Co. or equal.
- B. Alternate Power Factor Correction Equipment (Non-Linear Loads)
 - 1. Units shall be designed to provide power factor correction in applications subject to the effects of harmonics.
 - 2. Units shall consist of power factor correction capacitors equipped with series inductors. The units shall be tuned to just below the 5th harmonic frequency on systems with predominately 3 Phase loads.
 - 3. Capacitors shall be NEMA rated and tested, shall be non-PCB dielectric, biodegradable, low toxicity, equipped with current limiting fuses, internal discharge resistors and fuse loss indicators. Fuses shall be capable of interrupting a short circuit of 100,000 Amps at 480 Volts, 3 Phase.

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- C. Inductors shall have low flux density and distributed gaps, copper windings, brazed connections, winding varnish impregnated and baked, Class 220°C insulation with 80°C rise.

2.15 SINGLE-PHASE MOTOR

- A. Motors 1/6 Through 1/2 Horsepower: Provide single-phase NEMA Design N, squirrel cage induction motors
- B. Motors smaller than 1/6 Horsepower: Provide single-phase squirrel cage induction motors with integral thermal protectors.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The CONTRACTOR shall make all electrical connections to equipment specified. Installation shall be made in compliance with manufacturer's recommendations and the Drawings. If the Drawings or shop drawings and recommendations from the Manufacturer are not available then installation shall proceed according to the best electrical industry and trade practice.
- B. Properly install and align motors in the locations shown, except motors which are factory mounted on the driven equipment. When the motor and equipment are installed, the name-plate must be in full view.
- C. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports.

3.02 PERFORM THE FOLLOWING FIELD TESTS AND INSPECTIONS AND PREPARE TEST REPORTS

- A. Perform each electrical test and visual and mechanical inspection, stated in NETA ATS "Rotating Machinery, AC Induction Motors and Generators" Certify compliance with test parameters.

3.03 MOTOR DATA SHEET

- A. The Motor Data Sheet included after "END OF SECTION" shall be part of this section.

END OF SECTION

Odor Control Improvements for 11th St Bio-Scrubber Facility
WBS No. R-000020-0010-3 **COMMON MOTOR REQUIREMENTS FOR EQUIPMENT**

ELECTRICAL MOTOR DATA SHEET

Manufacturer: _____ Model: _____ HP: _____

Motor

Service: _____ Starting Conditions: _____

Frame: _____ Enclosure: _____

Voltage: _____ Phases: _____ RPM: _____ Hertz: _____

Insulation Class: _____ Duty: _____

Full Load AMPS: _____ No. Load AMPS: _____

Locked Rotor AMPS: _____ Locked Rotor Time: _____

Locked Rotor Torque: _____ % Breakdown Torque: _____%

NEMA Design: _____ Service Factor: _____

Number of Consecutive Starts: _____ Hot: _____ Cold: _____

Full Load Temp Rise, degrees C over 40 degrees C Ambient
(at 1.0 S.F.): _____

Service Factor Temp Rise, degrees C over 40 degrees C
(at 1.15 S.F.): _____

Drive System: _____ V-Belt _____ Direct Coupled _____ Gear Unit

Bearings: Type: _____ Life: _____ Lubrication: _____

Shaft: Size _____

	Efficiency:	Power Factor:	Current:
1.15 S.F. Load:	_____	_____	_____

4/4 Load:	_____	_____	_____
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3/4 Load:	_____	_____	_____
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1/2 Load:	_____	_____	_____
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Monitoring

Devices: _____ RTD's _____ Vibration Sensors _____ Thermistors

Main Motor Leads, size hole _____ Space Heater: _____ KW

Ground Lug Size _____ Surge Protection: _____

Blank spaces are to be completed by manufacturer.

Section 11009

COMMON CONTROL PANEL REQUIREMENTS FOR EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes control panels supplied by equipment manufacturers to manually or automatically operate the mechanical equipment.

1.03 SUBMITTALS

- A. Product Data: For each type of control panel provide manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For control panel or system.
 - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Control panel outline drawings showing elevation, plan and interior views, front panel arrangement, dimensions, weight, shipping splits, conduit entrances and anchor bolt pattern. Indicate all options, special features, ratings and deviations from this Section. Furnish complete Bill of Materials indicating manufacturer's part numbers.
 - b. Power and control schematics including external connections. Show wire and terminal numbers and color coding.
 - c. Instruction and replacement parts books.
 - d. Certified shop test reports.
 - e. As-built final drawings.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For control panels, installed devices, and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section 01782 "Operation and Maintenance Data," include the following:
 - 1. Routine maintenance requirements for control panels and all installed components.
 - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- E. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
- F. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that dip switch settings for motor running overload protection suit actual motor to be protected.
- G. Configuration Settings: Compile after panel has been installed and tested, all configuration or program settings, of VFDs, meters, controllers, timers, etc in documentation format.

**COMMON CONTROL PANEL REQUIREMENTS
FOR EQUIPMENT**

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Control panel manufacturer shall demonstrate at least three years of continuous field operating experience in control panel design and fabrication. Submit customer/user list with telephone numbers, addresses and names of customer/user representatives.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle and store control panels in accordance with manufacturer's instructions, the requirements of Division 1 Section 01600 "Product Requirements, and the following paragraphs.
- B. Package the control panel for maximum protection during delivery and storage.
- C. Store the control panel indoors in a clean, dry, heated storage facility until ready for installation. Do not install the control panel in its final location until the facilities are permanently weather tight. Protect the control panel at all times from exposure to moisture, chemicals, hydrogen sulfide and chlorine gas.

1.06 PROJECT CONDITIONS

- A. Control Panel Requirements: Refer to P&ID, instrumentation and electrical Drawings and to the various pump and equipment Sections for specific control panel requirements, such as:
 - 1. Controls to be mounted on panel face.
 - 2. Inputs and outputs and basic control logic.
 - 3. Motor starters, VFD's, and related control components.
 - 4. Power supply.
 - 5. Whether controls are face mounted or a swing-out panel face provided.
- B. Environmental Requirements: 110oF ambient temperature, 100% humidity, and direct sunlight.

1.07 COORDINATION

- A. Coordinate layout and installation of control panels with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section 03300 "Cast-in-Place" Concrete."
- C. Coordinate features of motor-control centers, installed units, and accessory devices with pilot devices and control circuits to which they connect.

**COMMON CONTROL PANEL REQUIREMENTS
FOR EQUIPMENT**

- D. Coordinate features, accessories, and functions of each motor-control center, each controller, and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.
- E. Refer to the detailed mechanical equipment specifications and drawings for description of system operation.

1.08 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.
- B. Spare part requirements shall be as indicted in Table 1

Table 1		
Description	Percent of Each Type and Size Used	No Less Than
Dc power supplies	20	2
Fuses	20	10
Relays and bases	20	10
Analog surge protectors	20	3
Power line surge protectors	20	2

PART 2 PRODUCTS

2.01 RATING

- A. The control panel shall operate at 480V, 3-Phase, 60 Hz, unless otherwise indicated in equipment specification or as shown on Drawings.
- B. The overall withstand and interrupting rating of the equipment and devices shall not be less than 42,000 amperes R.M.S. symmetrical at 480 Volts. All circuit breakers and combination motor starters shall be fully rated for the above fault current interrupting capacity. Series connected short circuit ratings will not be acceptable.
- C. The complete control panel assembly shall be UL certified or carry a UL listing for "Industrial Control Panels"
- D. The control panel shall meet all applicable requirements of the National Electrical Code.

2.02 PANEL REQUIREMENTS

- A. Indoor Single-Door Free-Stand with 3-Point Latch, Type 4 basic specification:
 - 1. Requirements
 - a. Dimensions: As Required
 - b. Material: 12 gauge mild steel
 - c. Finish: Polyester paint
 - d. Handle: 3-point with power glide handle
 - e. Lifting eyes: Two (2)
 - f. Hinge and hinge pin: Continuous hinge with stainless steel pin
 - g. Shelf: 18"x18" folding
 - h. Data Pocket: 12"x12"x3.5"
 - i. Light: LED Enclosed Light with Door Switch
 - j. Door Switch: For intrusion and Light
 - k. Ground Buss Bar: 1"x.25" tinned plated with required connections

**COMMON CONTROL PANEL REQUIREMENTS
FOR EQUIPMENT**

2. Model Hoffman Type 4 Free-Stand Series
 - B. Indoor Two-Door Free-Stand with 3-Point Latches, Type 4 basic specification:
 1. Requirements
 - a. Dimensions: As Required
 - b. Material: 12 gauge mild steel
 - c. Finish: Polyester paint
 - d. Handle: Two (2) 3-point with power glide handle
 - e. Lifting eyes: Two (2)
 - f. Hinge and hinge pin: Continuous hinge with stainless steel pin
 - g. Shelf: 18"x18" folding
 - h. Data Pocket: 12"x12"x3.5"
 - i. Light: Two (2) LED Enclosed Light with Door Switch
 - j. Door Switch: Two (2) For intrusion and Light
 - k. Ground Buss Bar: 1"x.25" tinned plated with required connections
 2. Model Hoffman Two-Door with 3-Point Latches Type 4 Series
 - C. Outdoor Single Door Wall Mounted with 3-Point Latch, Type 4X basic specification:
 1. Requirements
 - a. Dimensions: As Required
 - b. Material: 12 gauge 304 Stainless Steel
 - c. Finish: White Polyester paint
 - d. Handle: 3-point with power glide handle. Pad lockable
 - e. Data Pocket: 12"x12"x1" thermoplastic
 - f. Light: LED Enclosed Light with Door Switch
 - g. Door Switch: For intrusion and Light
 - h. Vent Drain: 304 Stainless Steel
 - i. Door Stop: 316 Stainless Steel
 2. Model Hoffman Painted White with 3-Point Latch, Type 4X
 - D. Temperature Control:
 1. Enclosure Heaters
 - a. Provide thermostatic controlled heaters when indicated on the drawings or Instrument Panel Schedule after END OF SECTION. Heaters shall be size to maintain an environment within the manufacturer's rating for all equipment within the cabinet.
 2. Air Conditioners
 - a. Provide thermostatic controlled air conditioners when indicated on the drawings or shown in the Instrument Panel Schedule at the after END OF SECTION. Air conditioners shall not void the NEMA 4 rating of the panel. Air conditioners shall be size to maintain an environment within the manufacturer's rating for all equipment within the cabinet.
- 2.03 INCOMING POWER BREAKER, DISTRIBUTION BREAKERS AND SURGE PROTECTION
- A. Each panel shall be supplied with a 120 VAC main power circuit breaker:
 1. 120 VAC Main Power Circuit Breaker basic specification
 - a. Requirements
 - 1) Mounting: DIN Rail
 - 2) Interrupting Rating: 10KAC
 - 3) Design: Finger Safe
 - 4) Handle: Three Position (On, Tripped, Off)
 - b. Model Allen Bradley 1492-MC Circuit Breaker
 - B. Each panel shall be supplied with separate a 120 VAC distribution circuit breakers for the enclosure light, enclosure heater, enclosure AC unit, service receptacle, 24 VDC supply/UPS and a common breaker feeding fuse blocks for the field instruments.

1. Distribution Circuit Breaker basic specification
 - a. Requirements
 - 1) Mounting: DIN Rail
 - 2) Interrupting Rating: 10KAC
 - 3) Design: Finger Safe
 - 4) Handle: Three Position (On, Tripped, Off)
 - b. Model Allen Bradley 1492-MC Circuit Breaker
- C. Each panel shall be provided with a 120 VAC, power line surge protector:
 1. Incoming 120 VAC Main Surge Protection basic specification
 - a. Requirements
 - 1) Mounting: DIN Rail
 - 2) Remote Fault Indicator: Optical and N/C Contact
 - 3) Surge Voltage Category: Type 3
 - b. Model Phoenix Contact PT 2-PE/S

2.04 POWER SUPPLY AND UPS REQUIREMENTS

- A. Each panel shall be supplied with a 24 V DC power supply and an Uninterruptible power supply combination, if shown scheduled.
 1. Power Supply basic specification:
 - a. Requirements
 - 1) Type: Primary Switched
 - 2) Mounting: DIN Rail
 - 3) Input Voltage: 100...240 V AC
 - 4) Output Voltage: 24 V DC +/-1%
 - 5) Status Indicator: DC OK Green LED
 - 6) Output Current: Sized, with 50% safety factory
 - b. Model Phoenix Contact Quint-PS Series
 2. Uninterruptible Power Supply Unit basic specification:
 - a. Requirements
 - 1) Battery: Maintenance Free Lead-Gel
 - 2) Mounting: DIN Rail
 - 3) Input Voltage: 24 V DC
 - 4) Output Voltage: 24 V DC
 - 5) Status Indicator: Four (4) LEDs
 - 6) Status Outputs: Three (3) 30 V DC, 1 A.
 - 7) Buffer Period: 15 Minutes at Full Load, with external battery
 - b. Model Phoenix Contact Quint-DC-UPS Series

2.05 TERMINAL AND FUSE BLOCKS

- A. Terminal and Fuse Blocks basic specification:
 1. Requirements
 - a. Type: IEC Listed, Screw Connection
 - b. Mounting: DIN Rail
 - c. Terminal Contact Material: Nickel Plated
 - d. Set Screw Material: Stainless Steel
 - e. Fuse Blocks: Blown Fuse Indicator
 - f. Feed Through Blocks: Single Level, Standard Size
 - g. Discrete Circuit Feed Blocks: Single Level, Standard Size
 - h. Analog Circuit Feed Blocks: Single Level, Knife Disconnect, Test Screws
 - i. Color: Match wire color identification
 2. Model Allen Bradley 1492-W Series

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2.06 RELAYS

A. Interposing Relay:

1. Each discrete circuit and spare circuits shall have an interposing relay in line to prevent any over voltage surge coming cross to the PLC I/O boards. Interposing relay shall be properly sized for each different circuit.
2. Requirements
 - a. Mounting: Standard DIN Rail
 - b. Model: Indicator and Check Button
 - c. Coil Rating: As required
 - d. Contact Rating: SPDT 10A
 - e. Contact Material: Silver Cadmium Oxide
3. Model IDEC RH1B Series

B. Control Relay:

1. Requirements
 - a. Mounting: Standard DIN Rail
 - b. Model: Indicator and Check Button
 - c. Coil Rating: As required
 - d. Contact Rating: 5PDT 10A
 - e. Contact Material: Silver Cadmium Oxide
2. Model IDEC RH4B Series

2.07 SERVICE RECEPTACLE

A. Each panel shall be supplied with a service receptacle, if shown scheduled.

1. Service receptacle basic specification
 - a. Requirements
 - 1) Mounting: DIN Rail
 - 2) Rating: 15 Amp 125V
 - 3) Type: Ground Fault Interrupter (GFCI)
 - b. Model Allen Bradley 1492-REC15G

2.08 WIRING REQUIREMENTS

A. Panel Connection Wire and Cable:

1. Cables and wiring shall conform to requirements specified below.
 - a. Power and Control Cable:
 - 1) Single conductor stranded copper NFPA 70 Type MTW.
 - 2) Power wiring from the main circuit breaker to distribution breakers shall be 12 AWG minimum single conductor stranded copper.
 - 3) All other single conductor 120 VAC and 24 VDC power and common return wiring, common ground buses and all common logic bus circuits shall be No. 14 AWG minimum single conductor stranded copper.
 - 4) Circuits protected by 15 Amp circuit breakers shall be 14 AWG minimum single conductor stranded copper.
 - b. Signal Cable:
 - 1) Discrete DI/DO cable shall be No. 16 AWG stranded copper conductor.
 - 2) Analog AI/AO cable shall be No. 18 AWG stranded copper twisted pair shielded cable.

B. Wire Tagging:

1. Panel connection wiring shall be tagged at terminations with machine printed slip on type tags.
2. Provide wire/cable tag designations on all wiring diagrams submitted to the OWNER. Place tag within two inches of any wiring termination, affixing tag to prevent the tag from sliding more than two inches from the terminal as the result of gravity and vibration.

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3. Power and Control Circuits: Control circuit, logic bus and power circuit wires shall be tagged as follows:
 - a. Control Circuits: Individual connection wire tagged at both ends with a wire number. Placed tag on the wire within two inches of the terminal to which the wire is terminated. CONTRACTOR shall assign a unique number for each wire within a panel.
 - b. Power Circuits: All 120 VAC power wires tagged with the designation "120 VAC-" followed by the circuit breaker number shown on the Drawings, then followed by a letter designating whether the wire carries the line (L), neutral (N) or power ground (PG).
 - c. Positive 24 VDC Power Circuit and Power Bus Wires: Tagged with the designation "+24 VDC-" followed by the circuit breaker number shown on the Contract Drawings, and 24 VDC power returns shall be designated with "24 VDC COMMON".
4. Wire Colors: Control, logic bus and power conductors in panels shall have the insulation colors listed in Table 2.

Table 2	
Usage	Color
Line Power	Black
Neutral	White
Power Ground	Green
+24 VDC Panel Bus	Red
+24 VDC Field Bus	Orange
24 VDC Common	Gray
Control	Red
Status and Alarm	Blue

5. Signal Circuits:
 - a. Signal circuit multi-conductor cables shall be tagged at each end with the designation shown on the wiring diagram. Each signal conductor shall be tagged at each end with the designation of the terminal block to which it is connected.
 - b. Individual conductors in each pair of twisted-pair cable shall have distinctly different colors, such as black and white, black and clear.
 - c. Shield ground common wires connected between drain wire terminals shall be green and shall be tagged "SG".
- C. Terminal Tags, Covers and Markers:
1. Each terminal strip shall have a unique identifying alphanumeric code designation at one end and a plastic marking strip running the entire length with a unique number for each terminal.
 2. Assign terminal strip numbers from the number "1" and continuing in ascending cardinal order. The terminal strip designation shall be the letters "TB" followed by the terminal strip number. The strip and terminal point designations shall be machine printed and 1/8 inch high.
- D. Wiring Within Panels:
1. Restrain by plastic ties or slotted plastic wire-ways with snap covers or metal raceways.
 2. Hinge Wiring: Secure at each end so that bending or twisting will be around longitudinal axis or wire. Protect bend are with sleeve.
 3. Arrange wiring neatly, cut to proper length, and remove surplus wire.
 4. Provide abrasion protection for wire bundles which pass through holes or across edges of sheet meet.
 5. Splicing and tapping of wires, allowed only at device terminals or terminal blocks.

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6. Terminal 24V dc and analog signal circuits on separate terminals from ac circuit terminal blocks.
 7. Separate analog and dc circuits by at least 6-inches from ac power and control wiring, except at unavoidable crossover points and at device terminations.
 8. Arrange wiring to allow access for testing, removal, and maintenance of circuits and components.
 9. Plastic wire ducts fill: Do not exceed manufacturer's recommendations.
 10. Wires and cables shall have sufficient length to allow slack and to avoid any strain or tension in the wire or cable.
 11. Placed in the ducts in a straight, neat and organized fashion and shall not be kinked, tangled or twisted together.
- E. Wire Terminations:
1. Single wire and cable conductors shall be terminated according to the requirements of the terminal device.
 2. For captive screw pressure plate and screw terminals, appropriately sized lugs shall be used. Lugs shall be crimp on type that form gas tight connections. All crimping shall be done using a calibrated crimping tool made specifically for the lug type and size being crimped.
 3. On shielded cables, the drain wire shall be covered with insulating tubing along its full bare length between the cable jacket and the terminal lug or terminal pressure plate.
- F. PLC I/O Wiring and Device Requirements:
1. All PLC I/O logic circuit wiring inside the LPU panel shall conform to the requirements specified below:
 - a. Discrete Input and Output Wiring Requirement:
 - 1) Provide a fuse per common group.
 - 2) Each discrete input/output and each spare discrete input/output shall be furnished with an interposing relay hardwired to the feed through terminal as well.
 - b. Analog Input and Output Wiring Requirement:
 - 1) Provide a fuse for each analog signal.
 - 2) Each analog input/output and each spare analog input/output shall be furnished with a surge protection device hardwired to the fed through terminal block. Surge protection device shall be Phoenix Contact PT-2X2 series.
- 2.09 MISCELLANEOUS
- A. Face-mounted equipment shall be flush or semi-flush, with flat black escutcheons. Cutouts for future equipment and holes resulted from removal of existing devices shall be blanked off with suitable covers as required to retain the cabinet's NEMA rating. Component identification shall be hot ink stamped on the panel interior.
 - B. Hardware and Fittings: All miscellaneous hardware and fittings shall be Type 316 stainless steel.
- 2.10 MAIN DISCONNECT MEANS
- A. The main circuit breaker shall be a thermal-magnetic molded case breaker, Type FCL by Square D Company, or equal. Provide a flange mounted main power disconnect operating handle with mechanical interlock having a bypass that will allow the panel door to open only when the switch is in the OFF position.
- 2.11 MOTOR STARTER
- A. Type:

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1. Magnetic Controller: NEMA ICS 2, Class A, full voltage, non-reversing, across the line, unless otherwise indicated.
 2. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2, Class 20 tripping characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect and with appropriate adjustment for duty cycle.
- B. Contactors:
1. Size contactors according to Drawings. Sizes below NEMA 1 are not acceptable. Provide three main poles, the number and type of auxiliary contacts to perform the required functions and two spare auxiliary contacts, one normally open and one normally closed, rated 10 amperes (NEMA contact rating designation A600).
 2. Use double break contacts of silver-cadmium oxide or similar material to minimize sticking or welding.
 3. Provide contactor coils suitable for continuous operation at 120 volts, 60 hertz.
- C. Unless otherwise indicated larger on the Drawings, use the following minimum starter sized for motor horsepower and voltage. Under no circumstances shall smaller sizes be used even if mistakenly shown on the Drawings; IEC starters shall not be acceptable.

Table 1		
NEMA Size Starter	Horsepower 480 volt	Horsepower 208 volt
1	Up to 7.5	Up to 5
2	20	7.5
3	40	20
4	75	36
5	100	--

2.12 VARIABLE FREQUENCY DRIVES

- A. Description: NEMA ICS 2, pulse-width-modulated, variable frequency controller; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase, induction motor by adjusting output voltage and frequency.
1. Provide unit suitable for operation of premium-efficiency motor as defined by NEMA MG 1.
- B. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- C. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.
- D. Unit Operating Requirements:
1. Input ac voltage tolerance of 380 to 500 V, plus or minus 10 percent.
 2. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
 3. Minimum Efficiency: 96 percent at 60 Hz, full load.
 4. Minimum Displacement Primary-Side Power Factor: 96 percent.
 5. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
 6. Starting Torque: 100 percent of rated torque or as indicated.
 7. Speed Regulation: Plus or minus 1 percent.
 8. Ambient Temperature: 0 to 40 deg C.
- E. Isolated control interface allows controller to follow control signal over an 11:1 speed range.
1. Electrical Signal: 4 to 20 mA at 24 V.

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- F. Internal Adjustability Capabilities:
 - 1. Minimum Speed: 5 to 25 percent of maximum rpm.
 - 2. Maximum Speed: 80 to 100 percent of maximum rpm.
 - 3. Acceleration: 2 to a minimum of 22 seconds.
 - 4. Deceleration: 2 to a minimum of 22 seconds.
 - 5. Current Limit: 50 to a minimum of 110 percent of maximum rating.
- G. Self-Protection and Reliability Features:
 - 1. Input transient protection by means of surge suppressors.
 - 2. Under- and overvoltage trips; inverter over-temperature, overload, and overcurrent trips.
 - 3. Motor Overload Relay: Adjustable and capable of NEMA 250, Class 20 performance.
 - 4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
 - 5. Instantaneous line-to-line and line-to-ground overcurrent trips.
 - 6. Loss-of-phase protection.
 - 7. Reverse-phase protection.
 - 8. Short-circuit protection.
 - 9. Motor over-temperature fault.
- H. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Restarting during deceleration shall not damage controller, motor, or load.
- I. Power-Interruption Protection: Prevents motor from re-energizing after a power interruption until motor has stopped.
- J. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.
- K. Integral Disconnecting Means: NEMA AB 1, molded-case switch with lockable handle.
- L. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.
- M. Line Reactor: Unit shall have 5% Line Reactor and 5% DC Bus Choke.
- N. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Allen Bradley.
 - 2. Danfoss.
 - 3. Yaskawa.

2.13 CONTROL POWER SOURCE

- A. 120 volts for control power shall be obtained with the use of a control power transformer. Each starter cubicle shall be equipped with two primary power leads connected to power phases 1 and 2 on the load side of the circuit breaker. Fuse both primary leads using fused pull-out type terminal blocks, appropriately identified. Fuse the secondary line leading from the transformer terminal X1. Ground the line leaving terminal X2.

2.14 PILOT DEVICES

- A. Indicating Lights:

Indicator lamps shall be heavy duty, industrial type, high-visibility LED, full voltage type. Units shall have screw on plastic lenses and shall have factory engraved legend plates as specified. Lens color shall as indicated in Table 2 and 3. For all control applications indicator lamps shall incorporate a push-to-test feature. Indicator lamps shall be by Allen-Bradley or equal.

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- B. Selector Switches:
1. Mode selector switches (HAND-OFF-AUTO, LOCAL-OFF-REMOTE, PUMP SELECTOR, LEAD-LAG, etc) shall be heavy-duty, industrial type with contacts rated for 120 VAC at 10 Amps continuous.
 2. Units shall have standard size, with colors as indicated. Operators shall be black knob type.
 3. Units shall have the number of positions and contact arrangements, as required. Units shall be single-hole mounting, accommodating panel thicknesses from 1/16-in minimum to 1/4-in maximum.
 4. Selector switches shall be by Allen-Bradley or equal.

- C. Push-Buttons:
1. Push-button, shall be heavy-duty, industrial type with momentary or maintained contacts as required, rated for 120 VAC at 10 Amps continuous.
 2. Units shall have standard size, with colors as indicated. Button color shall as indicated in Table 2 and 3. Contact arrangement shall be as required.
 3. Push-buttons shall be by Allen-Bradley or equal.

2.15 PUSHBUTTONS AND LIGHT COLORS AND INSCRIPTIONS

- A. Standard Pushbuttons Colors and Inscriptions: Use the following color code and inscriptions for pushbuttons, unless otherwise noted in the Instrument List.
1. Unused or Non-inscribed Buttons: Black.
 2. Lettering Color:
 - a. Black on white and yellow buttons.
 - b. White on black, red and green buttons.

Table 2 Standard Pushbuttons		
Tag Function	Inscription(s)	Color
OO	ON	Red
	OFF	Green
OC	OPEN	Red
	CLOSE	Green
OCA	OPEN	Red
	CLOSE	Green
	AUTO	White
OOA	ON	Red
	OFF	Green
	AUTO	White
MA	MANUAL	Yellow
	AUTO	White
SS	START	Red
	STOP	Green
RESET	RESET	Red
EMERGENCY STOP	EMERGENCY STOP	Red

- B. Standard Light Colors and Inscriptions: Use color codes in the following table and inscriptions for service legends and lens colors for indicating lights, unless otherwise noted in the Instrument List.
1. Lettering Color:
 - a. Black on White and amber lenses.
 - b. White on red and green lenses.

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Table 3		
Standard Light Colors		
Tag Function	Inscription(s)	Color
ON	ON	Red
OFF	OFF	Green
OPEN	OPEN	Red
CLOSED	CLOSED	Green
LOW	LOW	Green
FAIL	FAIL	Red
HIGH	HIGH	Amber
AUTO	AUTO	White
MANUAL	MANUAL	Yellow
LOCAL	LOCAL	White
REMOTE	REMOTE	Yellow

2.16 ELAPSED TIME METER

- A. A six digit, non-resetable elapsed time meter shall be connected to each motor starter. Meter shall be Bulletin 705, HK Series by Eagle Signal or equal.

2.17 ALARM HORN AND BEACON

- A. A failure alarm with horn and beacon light shall be provided. Silence and reset buttons shall be furnished. Alarm horn and beacon shall be by Federal Signal or equal.

2.18 TIME DELAY RELAYS

- A. Control relays shall be 300 Volt, industrial rated, plug-in socket type, housed in a polycarbonate dust cover, designed in accordance with UL Standard 508 for motor controller duty. Continuous contact rating shall be 15 Amps resistive, 1/2 Hp, at 120 VAC, with an operating temperature of minus 10 to plus 55 degrees C. NEMA open terminal block base. Relays shall be Allen Bradley 700-H or equal.

2.19 ALTERNATOR

- A. An alternator shall be provided to sequence motors. Alternator shall be Catalog No. 008-120-13SP or 009-120-23AP by Stacon; Square D, Class 9039, Type HG-21 or equal.

2.20 TIMERS

- A. Panel mounted timers shall be flush mounted, plug-in type, Eagle Signal Bulletin 125 cycle-flex or equal, with ranges as shown on the Drawings, or as required by the detailed mechanical equipment specifications.

2.21 POWER TERMINAL BLOCKS

- A. Power Wire Terminal Blocks (Motors, Solenoids, Valves, etc.):
 1. Terminal blocks shall be NEMA Open System. Blocks shall be one-piece molded plastic blocks with screw type terminals and barriers rated for 600 volts.
 2. Terminals shall be double sided and supplied with removable covers to prevent accidental contact with live circuits.
 3. Terminals shall have permanent, legible identification, clearly visible with the protective cover removed.
 4. Wires shall be terminated to the terminal blocks with crimp type, pre-insulated, ring-tongue lugs. Lugs shall be of the appropriate size for the terminal block screws and for the number and size of the wires terminated.

- B. Terminal Tags, Covers and Markers:
 - 1. Each terminal strip shall have a unique identifying alphanumeric code designation at one end and a plastic marking strip running the entire length with a unique number for each terminal.
 - 2. Assign terminal strip numbers from the number "1" and continuing in ascending cardinal order. The terminal strip designation shall be the letters "TB" followed by the terminal strip number. The strip and terminal point designations shall be machine printed and 1/8 inch high.
 - 3. Terminal blocks carrying 120 VAC power circuits shall be provided with a transparent, hinged cover for personnel protection and accessibility.

2.22 NAMEPLATES AND TAGS

- A. Panel Nameplates: Enclosure identification located on the enclosure face.
 - 1. Locations and Inscription: As shown.
 - 2. Materials: Laminated plastic attached to panel with stainless steel screws.
 - 3. Letters: 1/2-inch white on black background, unless otherwise noted.
- B. Component Nameplates, Panel Face: Component identification located on panel face under or near component.
 - 1. Locations and Inscription: As shown.
 - 2. Materials: Laminated plastic attached to panel with stainless steel screws.
 - 3. Letters: 3/16-inch white on black background, unless otherwise noted.
- C. Component Nameplates, Back of Panel: Component identification located on or near component inside enclosure.
 - 1. Locations and Inscription: As shown.
 - 2. Materials: Adhesive backed laminated plastic.
 - 3. Letters: 3/16-inch white on black background, unless otherwise noted.
- D. Legend Plates for Panel Mounted Pushbuttons, Lights, and Switches.
 - 1. Inscriptions: Refer to
- E. Service Legends: Component identification nameplate located on face of component.
 - 1. Inscription: As shown.
 - 2. Materials: Adhesive backed laminated plastic.
 - 3. Letters: 3/16-inch white on black background, unless otherwise noted.
- F. Nametags: Component identification for field devices:
 - 1. Inscription: Component tag number.
 - 2. Materials: 16-gauge, Type 304 stainless steel.
 - 3. Letters: 3/16-inch imposed.
 - 4. Mounting: Affix to component with 16- or 18-gauge stainless steel wire or stainless steel
 - Locations and Inscription: As shown.
 - 5. Materials: Adhesive backed laminated plastic.
 - 6. Letters: 3/16-inch white on black background, unless otherwise noted.

2.23 PROGRAMMABLE LOGIC CONTROLLER

- A. Requirements: When required by equipment specifications;
 - 1. PLC CPUs shall support not less than 96K sixteen-bit words of base user memory. The actual amount or use memory required shall be adequate for the functions to be performed, plus an allowance of 100% for future expansion.
 - 2. The CPU front panel will also include a RS-485 communication port for configuration, programming and diagnostics. It will also include and Ethernet 10/100 Base-T TCP/IP communication port. Additional communication ports shall be provided to allow for

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communication to Operator Interface Screen (OIS). Each process shall have 2 slots for a PCMCIA cards.

3. PLC shall be either as manufactured by GE, Siemens, Modicon, or Allen Bradley.

2.24 OPERATOR INTERFACE SCREEN

- A. When required by equipment specifications; Operator Interface Screen (OIS) shall be Allen Bradley, Series Panelview Plus 600 Gray Scale or equal.

2.25 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled instrument panel in the factory for compliance with these specifications in accordance with Division 17 Section 17000 "Instrumentation General Provisions" and the following:
 1. Verify that each wiring connection is made properly by checking electrical continuity, assuring that connections have less than one Ohm resistance end to end, and that no cross continuity exists between separate circuits.
 2. Conduct a test of all power circuits and power supply equipment to verify that proper voltages are delivered and all power supply equipment is operating according to the manufacturer's specifications.
 3. Functionally test each electrical device specified in Part 2 to verify correct operation.
 4. Test each input/output point. Inputs shall be exercised at the location in the panel the greatest distance in the circuit from the PLC chassis and verified through to the PLC processor. Results shall be demonstrated on a programming terminal. Each output shall be exercised from a programming terminal and verified through to the panel location the greatest distance in the circuit from the PLC chassis. At a minimum, analog inputs and outputs shall be tested at 0%, 25%, 50%, 75%, and 100% of range.
 5. Test the operator interface unit, including simulated alarm conditions.
 6. Test Ground Fault Interrupter (GFI) receptacles and circuit breakers for proper operation by methods sanctioned by the receptacle manufacturer.
 7. At the OWNER's option, a representative OWNER may witness the testing. Submit test report.

PART 3 EXECUTION

3.01 PANEL FABRICATION

- A. General Requirements:
 1. Panel with external dimensions and instruments arrangement as shown on Drawings. Adjustments, as necessary, can be made allowing each component to be mounted as recommended by the manufacturer, to facilitate easy installation, removal and in-place maintenance of each component, and to allow normal operation of the component by operating and maintenance personnel.
 2. Component arrangements shall allow space for routing of wiring without kinking or bending around sharp edges, and for free flow of air around and through equipment, which requires ventilation for cooling.
 3. Panel Construction and Interior Wiring: In accordance with the National Electrical Code, state and local codes, NEMA, ANSI, UL and ICECA.
 4. Fabricate panels, install instruments, wire, and plumb at the PICS factory.
 5. Electrical Work: Comply with the requirements of Division 16 Electrical.
- B. Factory Assemble: Assemble panels at the manufacturer's factory. No fabrication other than correction of minor defects or minor transit damage will be performed at the Project site.
- C. UL Label: Provide UL label on each panel stating "Listed Enclosed Industrial Control Panel."

3.02 FACTORY TESTS

- A. Factory Tests: Test and inspect assembled instrument panel in the factory for compliance with these specifications in accordance with Division 17 Section 17000 "Instrumentation General Provisions" and the following:
 - 1. Verify that each wiring connection is made properly by checking electrical continuity, assuring that connections have less than one Ohm resistance end to end, and that no cross continuity exists between separate circuits.
 - 2. Conduct a test of all power circuits and power supply equipment to verify that proper voltages are delivered and all power supply equipment is operating according to the manufacturer's specifications.
 - 3. Functionally test each electrical device specified in Part 2 to verify correct operation.
 - 4. Test each input/output point. Inputs shall be exercised at the location in the panel the greatest distance in the circuit from the PLC chassis and verified through to the PLC processor. Results shall be demonstrated on a programming terminal. Each output shall be exercised from a programming terminal and verified through to the panel location the greatest distance in the circuit from the PLC chassis. At a minimum, analog inputs and outputs shall be tested at 0%, 25%, 50%, 75%, and 100% of range.
 - 5. Test the operator interface unit, including simulated alarm conditions.
 - 6. Test Ground Fault Interrupter (GFI) receptacles and circuit breakers for proper operation by methods sanctioned by the receptacle manufacturer.
- B. At the OWNER's option, a representative OWNER may witness the testing.
- C. Test Report: Prepare a test report of findings for approval prior to shipment.

3.03 PANEL INSTALLATION

- A. CONTRACTOR shall coordinate panel delivery with the construction of the control room and panel locations to minimize field handling. Install panel as shown on the Drawings, in accordance with the shop drawings, and the manufacturer's instructions.

3.04 FIELD TESTING AND TRAINING

- A. Field Testing and Training Requirements: Comply with the requirements of Division 17 Section "Instrumentation General Provisions."

3.05 CLEANING AND ADJUSTING

- A. Repair affected surfaces to conform to type, quality, and finish of surrounding surface.
- B. Cleaning: Upon completion of Work, remove materials, craps, and construction debris from interior and around exterior of panels.

3.06 PROTECTION

- A. Protect panels and other equipment containing electrical, instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules.
- B. Periodically replace capsules in accordance with capsule manufacturer's recommendations.

END OF SECTION

Section 11016

COMMON REQUIREMENTS FOR PUMPS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Scope of Work:

1. This Section provides requirements common to the pumping unit specification sections of Division 11-Equipment. In addition to the specific requirements of the individual pumping unit specification sections, the CONTRACTOR shall be responsible for ensuring all pumping units comply with the requirements of this Section. The detailed equipment specifications shall govern where this section conflicts with detailed sections.
2. CONTRACTOR shall furnish and install all tools, equipment, materials, and supplies and shall perform all labor necessary for the installation, testing, and placing into operation of all pumps and pumping appurtenances, complete and operable, in accordance with the requirements of the Contract Documents.

B. Related Sections:

1. Division 11 Section 11005 "Common Motor Requirements for Equipment" for requirements for small and medium, ac motors, 250 Hp and smaller, 600V.
2. Division 11 Section 11009 "Common Control Panel Requirements for Equipment" for control panel components and enclosure for vendor furnished control panels for equipment.
3. Division 11 Section 11015 "Common Requirements for Equipment" for common requirements for equipment, material handling systems, special construction, and mechanical work.
4. Division 11 Section 11017 "Common Requirements for Chemical Feed Equipment Systems" for common requirements for chemical feed equipment and acceptable materials of construction for the chemicals to be handled.
5. Division 15 Section 15015 "Piping Systems-Basic Materials and Methods" for basic piping requirements associated with equipment systems, along with the individual piping sections.
6. Division 15 Section 15100 "Valves; Basic Requirements and Miscellaneous" for basic valve requirements associated with equipment systems, along with the individual valve sections.

1.03 REFERENCES

A. Reference Specifications, Standards, Codes, and Regulations:

1. Various Project sections contain references to specifications, standards, codes, regulations, and other documentation and shall be considered a part of those sections as specified and modified.
2. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly.
3. In the event of conflict between the requirements of the Project specification sections and those of the listed documents, the requirements of the Project specification sections shall prevail.
4. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Opening of Bid. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement

documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

- B. Commercial Standards: All equipment, products, and their installation shall be in accordance with the following standards, as applicable, and as specified in each Section of these specifications.
1. American Society for Testing and Materials (ASTM).
 2. American Public Health Association (APHA).
 3. American National Standards Institute (ANSI).
 4. American Society of Mechanical Engineers (ASME).
 5. American Water Works Association (AWWA).
 6. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).
 7. American Welding Society (AWS).
 8. National Fire Protection Association (NFPA).
 9. Federal Specifications (FS).
 10. National Electrical Manufacturers Association (NEMA).
 11. Rubber Manufacturers of America (RMA).
 12. Manufacturer's published recommendations and specifications.
 13. General Industry Safety Orders (OSHA).
- C. The following standards are referred to in the various Project specification sections:
1. American National standards Institute (ANSI):
 - a. B16.1 Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800.
 - b. B16.5 Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy, and Other Special Alloys.
 2. American Society of Mechanical Engineers (ASME):
 - a. B31.3 Process Piping Code.
 - b. B73.1 Specifications for Horizontal End Suction Centrifugal Pumps for Chemical Process.
 - c. B73.2 Specifications for Vertical In-Line Centrifugal Pumps for Chemical Process.
 3. American Water Works Association (AWWA):
 - a. E101 Deep Well Vertical Turbine Pumps-Line Shaft and Submersible Types.
 4. ASTM International, Inc. (ASTM):
 - a. A 48 Specification for Gray Iron Castings
 - b. A 470 Specification for Vacuum-Treated Carbon and Alloy Forgings for Turbine Rotors and Shafts.
 - c. A 536 Specification for Ductile Iron Castings.
 - d. E 448 Recommended Practice for Scleroscope Hardness Testing of Metallic Materials.
 - e. B 62 Specification for Composition Bronze or Ounce Metal
 - f. Castings.
 5. Hydraulic Institute Standards for Centrifugal, Rotary, and Reciprocating Pumps.
 6. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. 112 Test Procedure for Polyphase Induction Motors and Generators.
 - b. 115 Test Procedure for Synchronous Machines.
 7. National Electrical Manufacturer's Association (NEMA): MG-1, Motors and Generators.
 8. National Fire Protection Association (NFPA): NFPA 70, National Electric Code.
 9. National Sanitation Foundation (NSF): NSF 61, Drinking Water Components – Health Effects.

1.04 SUBMITTALS

- A. The information requested in the various Project specification sections shall be prepared and submitted in accordance with Division 1 Section 01330 "Submittal Procedures" and in accordance with the requirements described in the following paragraphs.
- B. Equipment and Related Lists: Lists are included for the convenience of the ENGINEER and CONTRACTOR and are not complete listings of all pumps, equipment, devices and material to

be provided under this Contract. The CONTRACTOR agrees to prepare his own material and equipment takeoff lists as necessary to meet the requirements of the Project.

- C. Manufacturer Installation Instructions: Instructions for field procedures for erection, adjustments, inspection, and testing shall be provided prior to installation of the pumping units.
- D. Pump Submittal Requirements: Following are supplemental requirements for pumping unit submittals.
 - 1. Manufacturer to indicate points on the head/capacity curves, and the limits recommended for stable operation which the pumps may be operated without surge, cavitation and vibration. The stable operating range shall be as wide as possible based on the pumps actual hydraulic and mechanical tests.
 - 2. Pump detailed description and specification.
 - 3. Electrical data, including power, signal, and control wiring diagrams, with terminals and numbers.
 - 4. Assembly and installation drawings including shaft size, seal, coupling, anchor bolt plan, part nomenclature, material list, outline dimensions and shipping weights.
 - 5. Pump drive and motor in accordance with applicable Division 11 motor specification section and variable frequency drive information in accordance with applicable Division 16 specification section.
 - 6. Bearing life calculations.
 - 7. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and include any motor specifications.
 - 8. Documentation demonstrating factory finish is equivalent to finish system specified in this Section.
- E. Information Submittals:
 - 1. Manufacturer's Certification of Compliance.
 - 2. Special shipping, storage and protection, and handling instructions.
 - 3. Manufacturer's Instructions for installation.
 - 4. Manufacturer's Certificate of Proper Installation.
 - 5. Qualification Data: For manufacturer and manufacturer's representative.
 - 6. Suggested spare parts list to maintain the equipment in service for a period of two years. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current pricing information.
 - 7. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
 - 8. Warranties and service agreements.
- F. Operation and Maintenance Data: For each pumping system to include in operation and maintenance manuals in accordance with Division 1 Section 01782 "Operation and Maintenance Data."
- G. Guarantees and Warranties: After completion, the CONTRACTOR shall furnish to the OWNER the manufacturer's written guarantees, that the pumping units will operate within the published efficiencies, heads, and flow ranges and meet these specifications.

1.05 QUALITY ASSURANCE

- A. Performance Curves: All centrifugal pumps shall have a continuously rising curve. In no case shall the required horsepower at any point on the performance curve exceed the rated horsepower of the motor or engine.
- B. Manufacturer Qualifications: Unless otherwise specified in the individual specification sections;
 - 1. All equipment shall be the product of a manufacturer which has been in the design, fabrication, assembly, testing, start-up and service of full scale pumping units with at least fifteen (15) North American installations of the type, model, and size specified for a period of not less than five (5) years prior to the bid date of this Contract.

2. A list of similar installations shall be furnished with the shop drawing submittal, including names and telephone numbers of contacts.
 3. Certified to ISO 9001 by an accredited certification agency.
- C. Installer Qualifications:
1. Unless otherwise specified in the individual specification sections; CONTRACTOR shall provide a manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
 2. Manufacturer's representative shall be provide for each pumping unit, 10 Hp and larger for the periods indicated in the individual specification section.
- D. Source Limitations: Pumping units of each type specified as specified in the individual specification sections shall be supplied by a single manufacturer. This does not require that all equipment be manufactured by a single manufacturer, but does require that the manufacturer of the system shall be responsible for the complete system.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle and store equipment components in accordance with shop drawings, manufacturer's written instructions, and the requirements of Division 1 Section 01600 "Product Requirements" or Section 01010 "General Construction Requirements" paragraph titled "Product Requirements," which ever is applicable.
- B. Special requirements for the storage and handling of pumping units will be provided in the specified pumping unit section.

1.07 PROJECT CONDITIONS

- A. Structural Performance: All equipment, supports, anchors and fasteners shall be of adequate size and strength to withstand loads associated with starting, turbulence, debris, thrusts from liquid movement, thermal expansion and contraction and other loads encountered under operating conditions.
- B. Operation: Equipment shall be designed and capable of either continuous or intermittent operation.
- C. System Arrangement:
 1. The equipment, sizes, materials, and arrangements described in the individual specification sections are typically based on recommendations by equipment manufacturers and shall be considered minimum limits of acceptability. The equipment MANUFACTURER shall be responsible for design, arrangement, and performance of all equipment supplied under this section.
 2. Modifications to structural design due to a manufacturer's varying space requirements, foundation requirements, floor slope requirements, dimension changes, or other requirements to fit manufacturer specific requirements shall be coordinated by CONTRACTOR and included in the Bid.
 3. The CONTRACTOR shall be responsible for any modifications to the piping, electrical, structural, and mechanical layouts to accommodate, as well reimbursement to OWNER for additional charges by ENGINEER for additional work required for accomplishing the changes.
- D. Environmental Conditions:
 1. All equipment, including controls and drives specified herein, shall be specifically designed for the service and the environment to be encountered.
 2. When installed in wastewater treatment areas, the environment will be moist, and corrosive, exhibiting hydrogen sulfide and other corrosive gases encountered in municipal wastewater treatment plants.

3. Designed and capable of operation at ambient temperatures of 0°F to 110°F.
 4. Furnish heat tracing and insulation as required, if required for exterior installation. Insulation alone shall not be sufficient to fulfill freeze protection provisions of this section.
- E. NSF Certified: All surfaces and materials in contact with water or in contact with a chemical being added to water that is being treated for potable water use and conveyance, shall comply with the requirements of the Safe Drinking Water Act and shall conform to NSF-61. Product shall bear the mark or seal of an accredited testing laboratory.
- F. Field Measurements, Existing Facilities Installation: Verify actual dimensions of openings, adjacent facilities and equipment, utilities and related items by field measurements before fabrication as applicable.

1.08 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components that fail(s) in materials or workmanship within specified warranty period.
1. Standard Warranty Period: Two (2) years from date of Substantial Completion. Standard warranty shall be Non-Pro Rated with unlimited hours of operation.
 2. Extended Warranty Period: Required when experience is below requirements stated in Quality Assurance paragraph. Three (3) years starting at the completion of the Standard Warranty Period. Extended Warranty Period may be Pro-Rated.
- B. Cost for the removal, shipment, repair and installation by CONTRACTOR shall be included in warranty, as well as correction of defective work.

1.09 SPARE PARTS AND TOOLS

- A. Tools: Provide special tools necessary for maintenance and repair of the pumps shall be furnished as a part of the work hereunder; such tools shall be suitably stored in metal tool boxes, and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the box.
- B. Spare Parts:
1. Obtain and submit from the manufacturer a list of recommended spare parts for each piece of equipment. After approval, furnish such spare parts suitably packaged, identified with the equipment number, and labeled.
 2. Furnish the name, address, and telephone number of the nearest distributor for each piece of equipment. All spare parts are intended for use by the OWNER, only, after expiration of the guaranty period.
 3. Any spare parts which the CONTRACTOR was permitted to use for startup activities shall be replaced by the CONTRACTOR prior to the OWNER's acceptance of beneficial use of the equipment.
 4. During the term of this Contract the CONTRACTOR shall notify the ENGINEER in writing about any manufacturer's modification of the approved spare parts, such as part number, interchangeability, model change or others. If the ENGINEER determines that the modified parts are no longer applicable to the supplied equipment, the CONTRACTOR at its expense shall provide applicable spare parts.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. The CONTRACTOR shall furnish and install only such equipment as the designated single manufacturer certifies is suitable for use with its equipment and the service conditions.
- B. All manufactured items provided under this Section shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products; such manufacturers shall have had previous experience in such manufacture and shall,

upon request of the ENGINEER, furnish the names of not less than five (5) successful installations of its equipment of comparable nature to that offered under this Contract.

- C. All combinations of manufactured equipment which are provided under these specifications shall be entirely compatible, and the CONTRACTOR and the designated single manufacturer shall be responsible for the compatible and successful operation of the various components of the units conforming to specified requirements. Each unit of equipment shall incorporate all basic mechanisms, coupling, electric motor or engine drive and unit mounting. All necessary mountings and appurtenances shall be included.
- D. Where two or more units of the same type and/or size of equipment are required, such units shall all be produced by the same manufacturer.
- E. Tolerance: Tolerances and clearances shall be as shown on the shop drawings and shall be closely adhered to. Machine work shall in all cases be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts.
- F. Machine Finish: The type of finish shall be the most suitable for the application and shall be shown in micro-inches in accordance with ANSI B46.1. The following minimum finishes shall be used:
 - 1. Surface roughness not greater than 63 micro-inches shall be required for all surfaces in sliding contact.
 - 2. Surface roughness not greater than 250 micro-inches shall be required for surfaces in contact where a tight joint is not required.
 - 3. Rough finish not greater than 500 micro-inches shall be required for other machined surfaces.
 - 4. Contact surfaces of shafts and stems which pass through stuffing boxes and contact surfaces of bearings shall be finished to not greater than 32 micro-inches.
- G. Noise Level:
 - 1. When the equipment is in operation, no single piece of equipment shall exceed the OSHA noise level requirements for a one hour exposure, and the regulatory agency having jurisdiction where the Project is located.
 - 2. The maximum allowable noise level shall correspond to the type of occupancy and area classification as specified and shown on the Drawings.
- H. For addition products requirements, refer to Division 1 Section 16000 "Product Requirements" or Division 1 Section 01010 "General Construction Requirements," paragraph titled "Product Requirements," which ever is applicable, for administrative and procedural requirements for selection of products for use in the Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

2.02 PUMPING UNIT REQUIREMENTS

- A. Materials: All materials furnished as part of the pumping equipment shall be suitable for its intended use and service. Materials not specifically called for shall be high-grade, standard commercial quality, free from all defects and imperfection that might affect the serviceability of the product for the purpose for which it is intended, and, unless otherwise specified in the individual specification section, shall conform to the following requirements:
 - 1. Cast iron pump casings and bowls shall be of close-grained gray cast iron, conforming to ASTM A48, or equal.
 - 2. Bronze pump impellers shall conform to ASTM B 62.
 - 3. Stainless steel pump shafts shall be of Type 400, Series. Miscellaneous stainless steel parts shall be of Type 316.
 - 4. All anchor bolts, nuts and washers shall be Type 316 stainless steel, unless otherwise specified.
 - 5. Buried or submerged bolts, nuts and washers shall be Type 316 stainless steel.

- B. Bearings: Unless otherwise specified, bearings shall comply with the requirements listed below.
1. Be oil or grease lubricated, ball or roller type, designed to withstand the stresses of the service specified.
 2. Rated in accordance with the latest revisions of ABMA Methods of Evaluating Load Ratings of Ball and Roller Bearings.
 3. Have a minimum L-10 rating life of 50,000 hours. The rating life shall be determined using the maximum equipment operating speed.
 4. Grease lubricated bearings, except those specified to be factory sealed and lubricated, shall be fitted with easily accessible grease supply, flush, drain and relief fittings. Extension tubes shall be used when necessary. Grease supply fittings shall be standard hydraulic alemite type.
 5. Oil lubricated bearings shall be equipped with either a pressure lubricating system or a separate oil reservoir type system. Each oil lubrication system shall be of sufficient size to safely absorb the heat energy normally generated in the bearing under a maximum ambient temperature of 60⁰ C and equipped with a filler pipe and an external level indicator gage.
- C. Couplings:
1. General: Pumps with a driver greater than 1/2 HP, and where the input shaft of a driven unit is directly connected to the output shaft of the driver, shall have its two shafts connected by a flexible coupling.
 2. Requirements:
 - a. Accommodate angular misalignment, parallel misalignment and end float, and cushions shock loads and dampens torsion vibrations.
 - b. Consist of a tire with synthetic tension members bonded together in rubber; flexible member attached to flanges by means of clamping rings and cap screws; and flanges attached to the stub shaft by means of taperlock bushings which provide the equivalent of a shrunk-on fit.
 - c. There shall be no metal-to-metal contact between the driver and the driven unit. Each coupling shall be sized and provided as recommended by the coupling manufacturer for the specific application, considering horsepower, speed of rotation, and type of service.
 - d. Where torque or horsepower capacities of couplings of the foregoing type is exceeded, provide Thomas-Rex, Falk Steel Flex, or equal couplings will be acceptable.
- D. V-Belt Drives:
1. V-belts and sheaves shall be of the best commercial grade and shall conform to ANSI and RMA Standards.
 2. Unless otherwise specified, sheaves shall be machined from the finest quality gray cast iron.
 3. Sheaves shall be statically balanced. For high speed application, where vibration is a problem, sheaves shall be dynamically balanced. Sheaves operating at high belt speeds may be required to be constructed of special materials.
 4. To facilitate installation and disassembly, sheaves shall be furnished complete with taper lock or QD bushings as required.
 5. Finish bored sheaves shall be furnished complete with keyseat and set screws.
 6. Sliding motor bases shall be provided to adjust the tension of V-belts.
- E. Flanges: Suction and discharge flanges shall conform to ANSI standard B16.1 or B16.5 dimensions.
- F. Lubrication:
1. Vertical pump shafts shall be product water-lubricated, unless otherwise specified. Deep-well pumps and pumps with dry barrels shall have water- or oil-lubricated bearings and seals.

2. For all vertical propeller, mixed-flow, and turbine pumps, other than deep well pumps, of bowl sizes 10-inch and larger, the CONTRACTOR shall provide a stainless steel tube attached to the column for grease lubrication of bottom bearing.
- G. Handholes: Handholes on pump casings shall be shaped to follow the contours of the casing to avoid any obstructions in the water passage.
- H. Vortex Suppressors: Vertical pumps with insufficient submergence shall be furnished with vortex suppressors.
- I. Drains: All gland seals, air valves, and cooling water drains, and drains from variable speed drive equipment shall be piped to the nearest floor sink, or drain, with galvanized steel pipe or copper tube, properly supported with brackets.
- J. Seals: Seals for water and wastewater pump shafts shall be either stuffing box or mechanical seals. Unless specified otherwise, stuffing boxes and mechanical seals shall be selected for highest reliability and for rugged service, conforming to the requirements set forth in this paragraph.
 1. Stuffing Boxes: Where stuffing boxes are specified for the pump seal, they shall be of the best quality, using the manufacturer's suggested materials best suited for the specific application.
 - a. For sewage, sludge, drainage, and liquids containing sediments, the seals shall be fresh-water flushed, using lantern rings.
 - b. Description: Stuffing boxes shall be tapped to permit introduction of seal liquid and shall hold a minimum of five rows of packing.
 - c. Stuffing boxes shall be face attached.
 - d. Stuffing box and shaft shall be suitable for field installation, without machining or other modifications, of the mechanical seal specified above for the applicable pump and operating conditions.
 - e. Lantern Rings: Bronze or Teflon, two-piece construction, and provided with tapped holes to facilitate removal.
 - f. Packing: Unless otherwise specified, the packing material shall be die-molded packing rings of interlaced Teflon braiding, containing 50 percent ultrafine graphite impregnation to satisfy the following specification:
 - 1) Shaft speeds - up to 2500 fpm
 - 2) Temperature - up to 500 degrees F
 - 3) pH range - 0-14
 - g. Glands: Bronze, two piece split construction.
 - h. Impeller end of the packing on all but line-shaft pumps with external source water lubricated bearings shall be fitted with a SpiralTrac, Version P packing protection system as manufactured by EnviroSeal Engineering Products, Ltd, Nova Scotia, Canada.
 2. Mechanical Seals:
 - a. Description: Mechanical seal shall be of a nondestructive (nonfretting) type requiring no wearing sleeve for the shaft. Shafts for pumps specified with mechanical seals shall be furnished with no reduction in size through the seal area.
 - b. Mechanical seals shall be the split cartridge type, requiring no field assembly, other than assembly around the shaft and insertion into the pump. Metal parts shall be Type 316 or 316L stainless steel. Springs shall be Hastalloy C.
 - c. Rotary Faces: Ceramic or silicon carbide.
 - d. Stationary Faces: Ceramic, tungsten carbide, or silicon carbide.
 - e. Elastomers: Ethylene propylene or fluorocarbon.
 - f. Service Operation: Full vacuum to 200 percent of the maximum specified operating pressure, but in any event not less than 200 psig.
 - g. Unless otherwise specified, mechanical seals for pumping equipment shall be self-aligning, self-centering, single, Chesterton 442, AES or equivalent.

- h. Mechanical seals for all pumps (except lineshaft pumps where the seal barrier fluid is used for lineshaft bearing lubrication) shall be fitted with SpiralTrac Version F, N or D, as recommended by EnviroSeal Engineering Products, Ltd, Nova Scotia, Canada.
 - i. Unless the pump manufacturer recommends a better seal for a specific application, the following mechanical seals shall be furnished with the pumps:

Sewage, Sludge, or Wastewater Pumps:	Double seals:
Abrasives, Grit, Lime Slurry Pumps:	Double seals:
Chemicals, and Corrosive Liquid Pumps:	Single seals:
Clean Water Pumps, Hot and Cold:	Single seals:
 - j. For all seal arrangements, a buffer fluid must be circulated a minimum 20 psi above suction pressure, or as required by manufacturer, in order to maintain reliable seal performance.
3. Shaft Sleeve:
- a. Section of shaft or impeller hub extending through or into the stuffing box shall be fitted with a replaceable stainless steel sleeve, having a Brinell hardness of not less than 500.
 - b. Sleeve held to the shaft to prevent rotation and gasketed to prevent leakage between the shaft and the sleeve.
 - c. Minimum shaft sleeve thickness shall be 3/8 inch.

2.03 PUMP APPURTENANCES

- A. **Manufacturer Nameplate:** Each pump shall be equipped with a stainless steel nameplate indicating rated head and flow, impeller size, pump speed, manufacturer's name and model number, and other appurtenant information.
- B. **Equipment Identification Plates:** A 16-gauge stainless steel identification plate shall be securely mounted on the equipment in a readily visible location. The plate shall bear 1/4-inch die-stamped equipment identification number indicated in this Section and/or on the Drawings.
- C. **Lifting Lugs:** Individual equipment and/or each field disassemble part weighing over 80 pounds shall be provided with lifting lugs
- D. **Anchor Bolts:** Provide template and Type 316 stainless steel anchors in accordance with Division 5 Section 05501 "Anchor Bolts, Expansion Anchors, and Concrete Inserts" and as shown on the Drawings. Size as required by manufacturer.
- E. **Initial Supply of Lubricants:** Manufacturer shall indicate types, brands, and quantities of initial lubricants, oil, grease, etc. necessary to startup equipment. CONTRACTOR shall provide and install the recommended lubricants and shall comply with all manufacturer recommended procedures.
- F. **Solenoid Valves:** The pump manufacturer shall furnish and install solenoid valves on the water or oil lubrication lines and on all cooling water lines. Solenoid valve electrical rating shall be compatible with the motor control voltage and shall be furnished complete with all necessary conduit and wiring installation from motor control panel to solenoid.
- G. **Pressure Gages:** Gage taps shall be provided on the suction and discharge sides of pumps (except sample pumps, sump pumps, and hot water circulating pumps) and shall be equipped with pressure gages installed at pump suction and discharge lines.
 - 1. Pressure gages shall be located in a representative location, where not subject to shock or vibrations, in order to achieve true and accurate readings.

2. Pressure gages shall be furnished in conformance with Division 15 Section 15099 "Pressure Gauges and Thermometers."
 3. Pump suction shall be equipped with compound gages. Where subject to shock or vibrations, provide a snubber, which is wall-mounted or attached to galvanized channel floor stands and connected by means of flexible connectors.
- H. Guards: Exposed moving parts shall be provided with guards which meet the requirements of OSHA. Guards shall be fabricated of minimum 14-gage galvanized steel or fiberglass; designed to be readily removable to facilitate maintenance of moving parts.
- I. Safety Signs: Provide the following safety signs in accordance with Division 10 Section 10442 "Safety Signs":
1. Equipment with guarded moving parts which operates automatically or by remote control shall be identified signs reading "CAUTION - EQUIPMENT STARTS AND STOPS AUTOMATICALLY."
 2. Place a caution sign on the guard reading "CAUTION- KEEP GUARD IN PLACE."

2.04 SOURCE QUALITY CONTROL

- A. CONTRACTOR shall be responsible for the coordination of the following tests of each of each pump, drive, and motor:
- B. General: Tests shall be performed in accordance with the Test Code for Centrifugal Pumps of the Standards of the Hydraulic Institute, Inc. Tests shall be performed on the actual assembled unit from shut-off head condition to 150 percent of the required maximum design capacity. Prototype model tests will not be acceptable.
- C. Factory Tests of Pumps:
1. All pumps and motors of sizes 10 to 125 hp (inclusive) shall be factory-tested in accordance with the above specifications. Submit the Certified test data to the ENGINEER. This data shall include, but not be limited to the following:
 - a. Hydrostatic test with data recorded.
 - b. Hydraulic test with a minimum of 5 readings between shutoff head and 125 percent of the maximum design capacity, recorded on data sheets as defined by the Hydraulic Institute, signed, dated, and certified.
 - c. Certification that the pump hp demand will not exceed the rated motor hp beyond the 1.0 service rating at any point on the curve.
 2. Vibration Test: Dynamically balance rotating parts of each pump and its driving unit before final assembly. Limits; Complete rotating assembly, including drive unit and motor, shall be less than 90 percent of limits established in the Hydraulic Institute Standards.
- D. Factory Tests of Motors: All motors of sizes 10 hp and larger, shall be assembled, tested, and certified at the factory and the working clearances checked to insure that all parts are properly fitted. The tests shall be in accordance with ANSI/IEEE 112 and ANSI/IEEE 115 standards, including heat run and efficiency tests. All computations shall be recorded and provide certified and dated copies of the test results to the ENGINEER.
- E. Factory Witnessed Tests: All pumps, variable speed drives, and motors, 150 hp and larger, shall be factory-tested as complete, assembled units, as specified above, and witnessed by the ENGINEER and the OWNER.
1. Manufacturer shall provide the ENGINEER a minimum of two (2) weeks notification prior to the test.
 2. All costs for OWNER and ENGINEER shall be borne by the CONTRACTOR and included in the bid price. Such costs shall include travel and subsistence for two people but shall exclude any salaries. Provide copies of the test results to the ENGINEER and no equipment shall be shipped until the test data have been approved.
- F. Acceptance: In the event of failure of any pump to meet any of the individual section requirements or efficiencies, the CONTRACTOR shall make all necessary modifications, repairs, or

replacements to conform to the requirements of the Contract Documents and the pump shall be re-tested at no additional compensation, until found satisfactory.

PART 3 EXECUTION

3.01 GENERAL

- A. Install and adjust equipment in accordance with the Drawings, approved shop drawings, and the manufacturer's instructions. Do not operate the equipment until the installation is approved by the manufacturer's representative.
- B. Comply with the requirements of Division 1 Section 01700 "Execution Requirements" or Section 01010 "Construction General Requirements" paragraph titled "Execution Requirements," which ever is applicable.

3.02 INSTALLATION

- A. Assemble and install equipment in accordance with the manufacturer's instructions and the following:
 - 1. Support all piping independently of the pump.
 - 2. Level baseplate by means of steel wedges (steel plates and steel shims). Wedge taper not greater the 1/4-inch per foot. Use double wedges to provide a level bearing surface. Accomplish wedging so that there is no change of level or springing of the base elbow when anchor bolts are tightened.
 - 3. Adjust pump assemblies such that the driving units are properly aligned, plumb, and level with the driven units and all interconnecting shafts and couplings. Do not compensate for misalignment by use of flexible couplings.
 - 4. After the pump and driver have been set in position, aligned, and shimmed to the proper elevation, grout the space between the bottom of the baseplate and the concrete foundation with a poured, non-shrinking grout of the proper category, as specified in Division 3 Section 03600 "Grout, Non-Shrink." Remove wedges after grout is set and pack void with grout.
 - 5. Complete equipment installation with controls, safety devices and auxiliary support systems necessary to start the equipment and verify that the equipment functions correctly under no load conditions. Turn rotating equipment by hand to check. Complete cleaning and testing of piping systems. Inspect and clean equipment, devices, piping, and structures of debris and foreign material.
 - 6. Remove temporary bracing supports and other construction debris that may damage equipment.
 - 7. Remove protective coatings and oils used for protection during shipment and installation.
 - 8. Flush, fill, and grease lubricated systems in accordance with manufacturer's instructions.
- B. Seal Water Connections: Provide seal water piping, valves, flow indicator, pressure and flow control devices, to pump packing for units handling slurries, grit, water containing sand or solids, and as specified in the drawings in accordance with the Standard Details.
- C. Base Plate Drains: Provide drain line from pumping unit base to the floor drain.
- D. Install temporary connections and devices required to fill, operate, checkout and drain the system. Provide temporary valves, gauges, piping, test equipment, and other materials and equipment necessary to conduct testing and startup.
- E. Equipment
 - 1. Check equipment for correct direction of rotation and freedom of moving parts.
 - 2. Align equipment to Manufacturer's tolerances. Adjust clearances and torques.
 - 3. Check installation prior to start-up for conformance to manufacturer's instructions.
 - 4. Adjust or modify equipment to ensure proper operation.
- F. Correct any deficiencies or problems noted in manufacturer's representative's installation reports.

3.03 PROTECTIVE COATING

- A. Provide polyurethane, pigmented (over epoxy zinc rich primer and high build epoxy) in accordance with Division 9 Section 09910 "Painting and Protective Coatings." Pump shall receive surface preparation, prime coat and finish coat in factory.
- B. Shop painted items which suffered damage to the shop coating shall be touched up as specified in Division 9 Section 09910 "Painting and Protective Coatings."

3.04 FIELD QUALITY CONTROL

- A. Functional Tests: Conduct on each pump as described below and in accordance with Division 1 Section 01810 "Equipment Testing and Facility Startup."
 - 1. Pumping units shall be field tested after installation, to demonstrate satisfactory operation, without causing excessive noise, vibration, cavitation, and overheating of the bearings.
 - 2. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
 - 3. Vibration Test:
 - a. Test units installed and in normal operation, and discharging to the connected piping systems at rates between the low discharge head and high discharge head conditions specified, and with the actual facility structures and foundations provided, shall not develop at any frequency or in any plane, peak-to-peak vibration amplitudes exceeding the limits specified.
 - b. Any vibration shall be within the amplitude limits recommended in the Hydraulic Institute Standards and it shall be recorded at a minimum of four (4) pumping conditions defined by the ENGINEER.
 - c. If units exhibit vibration in excess of the limits specified adjust, or modify as necessary. Units which cannot be adjusted or modified to conform as specified shall be replaced.
 - d. Flow Output: Measured by plant instrumentation and storage volumes.
- B. Performance Test: In accordance with Hydraulic Institute Standards.
 - 1. Place each piece of equipment in the system in operation until the entire system is functioning. All components shall continue to operate without alarms or shut downs, except as intended, for eight consecutive hours to be considered started up.
 - 2. Operate the equipment through the design performance range. Adjust, balance, and calibrate and verify that the equipment, safety devices, controls, and process system operate within the design conditions.
 - 3. Each safety device shall be tested for proper setting and signal. Response shall be checked for each equipment item and alarm. Simulation signals may be used to check equipment and alarm responses.
 - 4. Pump performance shall be documented by obtaining concurrent readings, showing motor voltage, amperage, pump suction head, and pump discharge head, for at least four (4) pumping conditions at each pump rpm. Each power lead to the motor shall be checked for proper current balance.
 - 5. Bearing temperatures shall be determined by a contact-type thermometer. A running time of at least 20 minutes shall be maintained for this test, unless liquid volume available is insufficient for a complete test.
- C. A copy of all information from functional tests, including data, worksheets, and other materials shall be turned over to the OWNER at the completion of the testing program.

3.05 MANUFACTURER'S SERVICES

- A. Manufacturers services shall comply with the requirements of Division 1 Section 01640 "Manufacturer's Services" and training shall comply with the requirements of Division 1 Section 01820 "Demonstration and Training."

1. Manufacturer's representative shall be provided present at Project site or classroom designated by OWNER, and depending of the Construction Schedule, provide the number of trips required to provide the minimum person-days listed in the individual specification sections, travel time excluded.
 - B. Inspection, Startup, and Field Adjustment: CONTRACTOR shall demonstrate that all equipment meets the specified performance requirements. CONTRACTOR shall provide the services of an experienced, competent, and authorized service representative of the manufacturer of each item of major equipment and shall visit the site of work to perform the following tasks.
 1. Assist the CONTRACTOR in the installation of the equipment.
 2. Inspect, check, adjust if necessary and approve the equipment installation.
 3. Start-up and field-test the equipment for proper operation, efficiency, and capacity.
 4. Perform necessary field adjustments during the test period until the equipment installation and operation are satisfactory to the ENGINEER.
 5. Instruct OWNER's personnel in the operation and maintenance of the equipment. Instruction prior to system testing of the equipment shall include step-by-step troubleshooting procedures with all necessary equipment testing.
 - C. Manufacture's Certificates:
 1. Provide equipment manufacturer's Certificate of Installation stating that the equipment is installed per the manufacturer's recommendations and in accordance with the Drawings and Specifications.
 2. Provide equipment manufacturer's Certificate of Performance stating that the equipment meets or exceeds the performance requirements as defined hereinbefore.
- 3.06 FACILITY STARTUP
- A. Startup of the facility shall be in accordance with Division 1 Section 01810 "Equipment Testing and Facility Startup." After initial startup under the supervision of a qualified representative of the pump manufacturer, a preliminary "running-in" period will be provided for the CONTRACTOR, per the Contract Documents, to make field tests and necessary adjustments. At the end of the specified period of operation, the pumps will be accepted if, in the opinion of the ENGINEER, the pumps has operated satisfactorily without excessive power input, wear, lubrication, or undue attention required for this operation, and if all rotating parts operate without excessive vibration or noise at any operating speed and head, including shutoff.

END OF SECTION

Section 11017

COMMON REQUIREMENTS FOR CHEMICAL FEED EQUIPMENT SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies requirements common to all chemical feed systems, storage tanks, day tanks, and related mechanical equipment as specified in the Divisions listed below.
 - 1. Division 11-Equipment for chemical pumps and chemical feed systems.
 - 2. Division 15-Mechanical for chemical day and storage tanks.
- B. In addition to the specific requirements of the individual specification sections, the CONTRACTOR shall be responsible for ensuring all chemical feed and storage systems comply with the requirements of this Section.
- C. CONTRACTOR shall furnish and install all tools, equipment, materials, and supplies and shall perform all labor necessary for the installation, testing, and placing into operation of all equipment, complete and operable, in accordance with the requirements of the Contract Documents.
- D. Related Sections:
 - 1. Division 1 Section 16010 "Basic Product Requirements" for administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
 - 2. Division 11 Section 11005 "Common Motor Requirements for Equipment" for requirements for small and medium, ac motors, 250 Hp and smaller, 600V.
 - 3. Division 11 Section 11009 "Common Control Panel Requirements for Equipment" for control panel components and enclosure for vendor furnished control panels for equipment.
 - 4. Division 11 Section 11016 "Common Requirements for Pumps" for common requirements for pumping units.
 - 5. Division 15 Section 15100 "Valves; Basic Requirements and Miscellaneous" for basic valve requirements associated with equipment systems, along with the individual valve sections.

1.03 REFERENCES

- A. Reference Specifications, Standards, Codes, and Regulations:
 - 1. Various Project sections contain references to specifications, standards, codes, regulations, and other documentation and shall be considered a part of those sections as specified and modified.
 - 2. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly.
 - 3. In the event of conflict between the requirements of the Project specification sections and those of the listed documents, the requirements of the Project specification section shall prevail.
 - 4. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Opening of Bid. If referenced documents have been discontinued by the

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issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

- B. Commercial Standards: All equipment, products, and their installation shall be in accordance with the following standards, as applicable, and as specified in each Section of these specifications.
 - 1. American Society for Testing and Materials (ASTM).
 - 2. American National Standards Institute (ANSI).
 - 3. American Society of Mechanical Engineers (ASME).
 - 4. American Water Works Association (AWWA).
 - 5. American Welding Society (AWS).
 - 6. National Fire Protection Association (NFPA).
 - 7. Federal Specifications (FS).
 - 8. National Electrical Manufacturers Association (NEMA).
 - 9. Rubber Manufacturers of America (RMA).
 - 10. General Industry Safety Orders (OSHA).

- C. The following standards are referred to in the various Project specification sections:
 - 1. National Electrical Manufacturer's Association (NEMA): MG-1, Motors and Generators.
 - 2. National Fire Protection Association (NFPA): NFPA 70, National Electric Code.
 - 3. National Sanitation Foundation (NSF): NSF 61, Drinking Water Components – Health Effects.

1.04 SUBMITTALS

- A. The information requested in the various Project specification sections shall be prepared and submitted in accordance with Division 1 Section 01330 "Submittal Procedures" and in accordance with the requirements described in the following paragraphs.

- B. Equipment and Related Lists: Lists are included for the convenience of the ENGINEER and CONTRACTOR and are not complete listings of all equipment, devices and material to be provided under this Contract. The CONTRACTOR agrees to prepare his own material and equipment takeoff lists as necessary to meet the requirements of the Project.

- C. Manufacturer Installation Instructions: Instructions for field procedures for erection, adjustments, inspection, and testing shall be provided prior to installation of the equipment.
 - 1. Guarantees and Warranties: After completion, the CONTRACTOR shall furnish to the OWNER the manufacturer's written guarantees, that the equipment will operate within the specified design and performance parameters and meet these specifications. CONTRACTOR shall also furnish the manufacturer's warranties as published in its literature and as specified.

- D. Product Data: For each type of product indicated, provide construction details, material descriptions and dimensions of individual components, including rated capacities, operating characteristics, instrumentation and electrical characteristics, and accessories.

- E. Shop Drawings: For each chemical feed system, include plans, elevations, sections, details, and attachments to other work.
 - 1. Manufacturer and model number of all equipment to be provided and an itemized list of components being furnished.
 - 2. Layout drawings including all proposed system components, dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Design performance characteristics, including, sizes, capacities, head, viscosity, and NPSH requirements over the operating ranges, and other appropriate information.
 - 4. Listing of materials of construction, coatings, and chemical compatibility.

5. Wiring Diagrams: For power, signal, and control wiring, including information on controls and monitoring devices furnished.
- F. Information Submittals:
1. Factory functional and performance test reports and log.
 2. Manufacturer's Certification of Compliance.
 3. Special shipping, storage and protection, and handling instructions.
 4. Manufacturer's instructions for installation.
 5. Manufacturer's Certificate of Proper Installation.
 6. Qualifications: Manufacturer and manufacturer's representative.
 7. Suggested spare parts list to maintain the equipment in service for a period of one year. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current pricing information.
 8. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
 9. Source quality-control reports.
 10. Field quality-control reports.
 11. Operation and Maintenance Data: Provide in accordance with Division 1 Section 01782 "Operation and Maintenance Data."

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Unless otherwise specified in the individual specification sections;
1. All equipment shall be the product of a manufacturer which has been in the design, fabrication, assembly, testing, start-up and service of full scale pumping units with at least fifteen (15) North American installations of the type, model, and size specified for a period of not less than five (5) years prior to the bid date of this Contract.
 2. A list of similar installations shall be furnished with the shop drawing submittal, including names and telephone numbers of contacts.
 3. Certified to ISO 9001 by an accredited certification agency.
- B. Installer Qualifications: Unless otherwise specified in the individual specification sections; CONTRACTOR shall provide a manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- C. Source Limitations: Equipment of each type specified as specified in the individual specification sections shall be supplied by a single manufacturer. This does not require that all equipment be manufactured by a single manufacturer, but does require that the manufacturer of the system shall be responsible for the complete system.
- D. Welding Qualifications: Qualify procedures and personnel according to one of the following American Welding Society (AWS) codes as applicable.
1. D1.1/D1.1M, "Structural Welding Code – Steel."
 2. D1.2/D1.2M, "Structural Welding Code – Aluminum."
 3. D1.3, "Structural Welding Code - Sheet Steel."
 4. D1.6, "Structural Welding Code--Stainless Steel."
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle and store equipment components in accordance with shop drawings, manufacturer's written instructions, and the requirements of Division 1 Section 01600 "Product Requirements" or Section 01010 "General Construction Requirements" paragraph titled "Product Requirements," which ever is applicable.

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- B. Special requirements for the storage and handling of chemical feed equipment systems will be provided in the specified pumping unit section.

1.07 PROJECT CONDITIONS

- A. Structural Performance: All equipment, supports, anchors and fasteners shall be of adequate size and strength to withstand loads associated with starting, turbulence, debris, thrusts from liquid movement, thermal expansion and contraction and other loads encountered under operating conditions.
- B. Operation: Equipment shall be designed and capable of either continuous or intermittent operation.
- C. System Arrangement:
 - 1. The equipment, sizes, materials, and arrangements described in the individual specification sections are typically based on recommendations by equipment manufacturers and shall be considered minimum limits of acceptability. The equipment MANUFACTURER shall be responsible for design, arrangement, and performance of all equipment supplied under this section.
 - 2. Modifications to structural design due to a manufacturer's varying space requirements, foundation requirements, floor slope requirements, dimension changes, or other requirements to fit manufacturer specific requirements shall be coordinated by CONTRACTOR and included in the Bid.
 - 3. The CONTRACTOR shall be responsible for any modifications to the piping, electrical, structural, and mechanical layouts to accommodate, as well reimbursement to OWNER for additional charges by ENGINEER for additional work required for accomplishing the changes.
- D. Environmental Conditions:
 - 1. All equipment, including controls and drives specified herein, shall be specifically designed for the service and the environment to be encountered.
 - 2. When installed in wastewater treatment areas, the environment will be moist, and corrosive, exhibiting hydrogen sulfide and other corrosive gases encountered in municipal wastewater treatment plants.
 - 3. Designed and capable of operation at ambient temperatures of 0°F to 110°F.
 - 4. Furnish heat tracing and insulation as required, if required for exterior installation. Insulation alone shall not be sufficient to fulfill freeze protection provisions of this section.
- E. NSF Certified: All surfaces and materials in contact with water or in contact with a chemical being added to water that is being treated for potable water use and conveyance, shall comply with the requirements of the Safe Drinking Water Act and shall conform to NSF-61. Product shall bear the mark or seal of an accredited testing laboratory.
- F. Field Measurements, Existing Facilities Installation: Verify actual dimensions of openings, adjacent facilities and equipment, utilities and related items by field measurements before fabrication as applicable.

1.08 SPARE PARTS AND TOOLS

- A. Tools: Provide special tools necessary for maintenance and repair of the pumps and equipment shall be furnished as a part of the work hereunder; such tools shall be suitably stored in metal tool boxes, and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the box.
- B. Spare Parts:
 - 1. Obtain and submit from the manufacturer a list of recommended spare parts for each piece of equipment. After approval, furnish such spare parts suitably packaged, identified with the equipment number, and labeled.

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2. Furnish the name, address, and telephone number of the nearest distributor for each piece of equipment. All spare parts are intended for use by the OWNER, only, after expiration of the guaranty period.
 3. Any spare parts which the CONTRACTOR was permitted to use for startup activities shall be replaced by the CONTRACTOR prior to the OWNER's acceptance of beneficial use of the equipment.
- C. During the term of this Contract the CONTRACTOR shall notify the ENGINEER in writing about any manufacturer's modification of the approved spare parts, such as part number, interchangeability, model change or others. If the ENGINEER determines that the modified parts are no longer applicable to the supplied equipment, the CONTRACTOR at its expense shall provide applicable spare parts.

1.09 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail(s) in materials or workmanship within specified warranty period.
1. Standard Warranty Period: Two (2) years from date of Substantial Completion. Standard warranty shall be Non-Pro Rated with unlimited hours of operation.
 2. Extended Warranty Period: Required when experience is below requirements stated in Quality Assurance paragraph. Three (3) years starting at the completion of the Standard Warranty Period. Extended Warranty Period may be Pro-Rated.
 3. Cost for the removal, shipment, repair and installation by CONTRACTOR shall be included in warranty, as well as correction of defective work.
- B. After completion, the CONTRACTOR shall furnish to the OWNER the manufacturer's written guarantees that the equipment will operate with the published efficiencies, heads, criteria, and flow ranges and meet these specifications. The CONTRACTOR shall also furnish the manufacturer's warranties as published in its literature and as specified.

PART 2 PRODUCT

2.01 GENERAL REQUIREMENTS

- A. The CONTRACTOR shall furnish and install only such equipment as the designated manufacturer certifies is suitable for use with its equipment and the service conditions.
- B. All manufactured items provided under this Section shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products; such manufacturers shall have had previous experience in such manufacture and shall, upon request of the ENGINEER, furnish the names of not less than five successful installations of its equipment of comparable nature to that offered under this Contract.
- C. All combinations of manufactured equipment which are provided under these specifications shall be entirely compatible, and the CONTRACTOR and the designated single manufacturer shall be responsible for the compatible and successful operation of the various components of the units conforming to specified requirements.
- D. Where two or more equipment of the same type and/or size are required, such units shall all be produced by the same manufacturer.
- E. Electric Motor Service Factor: Unless otherwise specified, service factor for electric motors shall be 1.15. For additional information refer to applicable Division 11 electric motor section.
- F. Calibration Graphs: The manufacturer's representative shall prepare a calibration graph from field tests for each chemical feed unit which does not have a rate set device reading in pounds per hour for dry feeders, or in gallons per hour for liquid feeders. The graph shall show the rate setter

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graduation conversion to pounds per hour or gallons per hour throughout the range of the feed unit. Each graph shall be furnished on hard paper and sealed in clear plastic.

- G. For addition products requirements, refer to Division 1 Section 16000 "Product Requirements" or Division 1 Section 01010 "General Construction Requirements" paragraph titled "Product Requirements," for administrative and procedural requirements for selection of products for use in the Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

2.02 EQUIPMENT

- A. Common requirements for equipment for chemical feed systems shall comply with the individual chemical feed system specification section and the applicable portions of Division 11 Section 11015 "Common Requirements for Equipment."

2.03 PUMPING UNITS

- A. Common requirements for pumping units for chemical feed systems shall comply with the individual chemical feed system specification section and the applicable portions of Division 11 Section 11016 "Common Requirements for Pumps."

2.04 MATERIALS

- A. General Requirements:
 1. Materials used in the fabrication and installation of chemical feed systems consisting of pumping units, day and storage tanks, chemical feed equipment, piping, valves, and related components shall be compatible with the chemical stored, conveyed, and processed.
 2. Manufacturer may use other materials than those listed for the chemical in the fabrication of equipment, pumping units, day and storage tanks, chemical feed systems, piping, valves, and related components when evidence is provided on the compatibility of the material with the chemical.
 3. Materials employed shall be suitable for the intended application; materials not specifically called for shall be high-grade, industrial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended.
- B. Corrosion Resistance: Materials used in the construction of chemical feeding systems shall be resistant to corrosive attacks from the chemicals. Table 1 list the most commonly used chemicals for water and wastewater treatment and some of the materials suitable for the construction of chemical handling and feed systems. Unless the manufacturer proposes more suitable materials, the table shall be adhered to.

Table 1 Materials, Chemical Feed and Storage Systems			
Chemical	Symbol	Form	Suitable Handling Material
Calcium Nitrate	Ca(NO ₃) ₂	Solution	Type 316 Stainless Steel, Hastelloy C, PVC, FRP (Suitable Grade), Viton, Hypalon, Nylon, Teflon, Rubber, Polypropylene
Ferrous Sulfate	FeSO ₄ ·7H ₂ O	Solution	Type 316 Stainless Steel, FRP (Suitable Grade), Hypalon, Teflon, Vinyl, Rubber, Tyril,

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Table 1 Materials, Chemical Feed and Storage Systems			
Chemical	Symbol	Form	Suitable Handling Material
			Ceramic
Sodium Bisulfite	Na ₂ S ₂ O ₅ (NaHSO ₃)	Anhydrous	Type 316 Stainless Steel, Carpenter 20 (stainless steel), PVC, FRP (Suitable Grade), Hypalon, Teflon, Tyril, Glass
Sodium Carbonate	Na ₂ CO ₃	Soda Ash	Iron, Steel, Carpenter 20 (stainless steel), Titanium, Hypalon, Teflon, PVC, FRP (Suitable Grade), Rubber, Tyril
Sodium Chloride	NaCl		Carpenter 20 (stainless steel), Hastelloy C, Titanium, PVC, FRP (Suitable Grade), Kynar, Hypalon, Teflon, Saran, Vinyl, Tyril, Glass
Sodium Chlorite	NaClO ₂		Hastelloy C, Titanium, CPVC, FRP (Suitable Grade), Hypalon, Penton, Polypropylene, Saran, Vinyl, Tygon, Tyril, Glass
Sodium Hydroxide	NaOH	Caustic Soda	Cast Iron (fair), Steel (fair), Type 304 and 316 Stainless steel (fair), PVC, CPVC, Teflon, EDPM, Hypalon, Rubber, Polypropylene
Sodium Hypochlorite	NaOCl		Hastelloy C, Titanium, PVC, Viton, Penton, Hypalon, Vinyl, Saran, Rubber, Polyethylene, Tyril, Glass
Sulfuric Acid	H ₂ SO ₄	Diluted	Cast Iron (concentrated only), Steel (concentrated only), Hastelloy C, Carpenter 20 (fair), FRP (Suitable Grade), CPVC, Aluminum Bronze, Teflon, Viton, Polypropylene, Glass, Duriron

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2.05 APPURTENANCES

- A. Nameplate: Each piece of equipment shall be equipped with a stainless steel nameplate, indicating equipment characteristics, capacity, motor horsepower, speed, electrical characteristics, manufacturer, model number, and serial number.
- B. Solenoid Valves: The equipment manufacturer shall furnish and install all solenoid valves which are part of the chemical feeding unit. The solenoid valve electrical rating shall be compatible with the equipment voltage and valves shall be furnished complete with the necessary conduit and wiring from the control panel to the solenoids. The valve material shall be suitable for the intended service.
- C. Pressure Gages: All chemical transfer and metering pumps, and other equipment, where shown, shall be equipped with pressure gages with diaphragm seals in accordance with Division 15 Section 15099 "Pressure Gauges and Thermometers," except that the size of gages on small metering pumps may be smaller than specified in the above section.
- D. Equipment Supports: All chemical feeding equipment and piping shall be firmly supported on concrete equipment pads or chemical support stand and anchored down. Fabricated metal supports and stands exposed to chemical spills shall be of Type 316 stainless steel. All anchor bolts, nuts, and washers of such supports shall be of type 316 stainless steel, using an anti-seize compound.
- E. Variable Speed Drives: Variable speed drives, drive motors, speed control equipment, and accessories shall be furnished in accordance with appropriate sections of these specifications.
- F. Safety Equipment: Where required by Code, all chemical unloading, storage, and feeding equipment shall be furnished with the necessary safety devices and warning signs, clearly visible.
- G. Guards: Exposed moving parts shall be provided with guards which meet the requirements of OSHA. Guards shall be fabricated of minimum 14-gage galvanized steel or fiberglass; designed to be readily removable to facilitate maintenance of moving parts.
- H. Safety Signs: Provide the following safety signs in accordance with Division 10 Section 10442 "Safety Signs":
 - 1. Equipment with guarded moving parts which operates automatically or by remote control shall be identified signs reading "CAUTION - EQUIPMENT STARTS AND STOPS AUTOMATICALLY."
 - 2. Place a caution sign on the guard reading "CAUTION- KEEP GUARD IN PLACE."

2.06 SOURCE QUALITY CONTROL

- A. Testing and inspection of the factory assembled equipment shall be accomplished by manufacturer prior to shipment. Upon satisfactory completion of testing, the units will be disassembled into subcomponent assemblies for shipment and installation. At the manufacturer's option, the units may also be shipped to the site as complete units, providing said units can be installed as a complete assembly.
- B. All control panels shall be factory tested under simulated operating conditions verifying all devices function.
- C. Complete factory performance assurance testing shall be required prior to shipment.

PART 3 EXECUTION

3.01 GENERAL

- A. Install and adjust equipment in accordance with the Drawings, approved shop drawings, and the manufacturer's instructions. Do not operate the equipment until the installation is approved by the manufacturer's representative.

- B. Comply with the requirements of Division 1 Section 01700 "Execution Requirements" or Section 01010 "General Construction Requirements" paragraph titled "Execution Requirements," which ever is applicable.

3.02 ASSEMBLY AND INSTALLATION

- A. Assemble and install equipment in accordance with the manufacturer's instructions and the following:
 - 1. Support all piping independently of the pump.
 - 2. Level baseplate by means of steel wedges (steel plates and steel shims). Wedge taper not greater the 1/4-inch per foot. Use double wedges to provide a level bearing surface. Accomplish wedging so that there is no change of level or springing of the base elbow when anchor bolts are tightened.
 - 3. Adjust equipment such that the driving units are properly aligned, plumb, and level with the driven units and all interconnecting shafts and couplings. Do not compensate for misalignment by use of flexible couplings.
 - 4. After the equipment have been set in position, aligned, and shimmed to the proper elevation, grout the space between the bottom of the baseplate and the concrete foundation with a poured, non-shrinking grout of the proper category, as specified in Division 3 Section 03600 "Grout, Non-Shrink." Remove wedges after grout is set and pack void with grout.
 - 5. Complete equipment installation with controls, safety devices and auxiliary support systems necessary to start the equipment and verify that the equipment functions correctly under no load conditions. Turn rotating equipment by hand to check. Complete cleaning and testing of piping systems. Inspect and clean equipment, devices, piping, and structures of debris and foreign material.
 - 6. Remove temporary bracing supports and other construction debris that may damage equipment.
 - 7. Remove protective coatings and oils used for protection during shipment and installation.
 - 8. Flush, fill, and grease lubricated systems in accordance with manufacturer's instructions.
- B. Install temporary connections and devices required to fill, operate, checkout and drain the system. Provide temporary valves, gauges, piping, test equipment, and other materials and equipment necessary to conduct testing and startup.
- C. Equipment
 - 1. Check equipment for correct direction of rotation and freedom of moving parts.
 - 2. Align equipment to Manufacturer's tolerances. Adjust clearances and torques.
 - 3. Check installation prior to start-up for conformance to manufacturer's instructions.
 - 4. Adjust or modify equipment to ensure proper operation.
- D. Correct any deficiencies or problems noted in manufacturer's representative's installation reports.

3.03 PROTECTIVE COATING

- A. Provide polyurethane, pigmented (over epoxy zinc rich primer and high build epoxy) in accordance with Division 9 Section 09910 "Painting and Protective Coatings." Pump shall receive surface preparation, prime coat and finish coat in factory.
- B. Shop painted items which suffered damage to the shop coating shall be touched up as specified in Division 9 Section 09910 "Painting and Protective Coatings."

3.04 FIELD QUALITY CONTROL

- A. Functional Tests: Prior to plant startup, the CONTRACTOR, with the assistance of the manufacturer's representative, shall inspect all equipment for proper assembly and alignment, quiet operation, and proper operation.

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- B. Performance Test: The manufacturer's representative shall conduct performance test on the equipment to certify compliance with the performance requirements.
 - 1. Place each piece of equipment in the system in operation until the entire system is functioning. All components shall continue to operate without alarms or shut downs, except as intended, for twenty-four (24) consecutive hours to be considered ready for facility startup.
 - 2. Operate the equipment through the design performance range consistent with available flows. Adjust, balance, and calibrate and verify that the equipment, safety devices, controls, and process system operate within the design conditions. Each safety device shall be tested for proper setting and signal. Response shall be checked for each equipment item and alarm. Simulation signals may be used to check equipment and alarm responses.
- C. A copy of all information from functional tests, including data, worksheets, and other materials shall be turned over to the OWNER at the completion of the testing program.

3.05 MANUFACTURER'S SERVICES

- A. Manufacturers services shall comply with the requirements of Division 1 Section 01640 "Manufacturer's Services" and training shall comply with the requirements of Division 1 Section 01820 "Demonstration and Training."
 - 1. Manufacturer's representative shall be provided present at Project site or classroom designated by OWNER, and depending of the Construction Schedule, provide the number of trips required to provide the minimum person-days listed in the individual specification sections, travel time excluded.
- B. Inspection, Startup, and Field Adjustment: CONTRACTOR shall demonstrate that all equipment meets the specified performance requirements. CONTRACTOR shall provide the services of an experienced, competent, and authorized service representative of the manufacturer of each item of major equipment and shall visit the site of work to perform the following tasks.
 - 1. Assist the CONTRACTOR in the installation of the equipment.
 - 2. Inspect, check, adjust if necessary and approve the equipment installation.
 - 3. Start-up and field-test the equipment for proper operation, efficiency, and capacity.
 - 4. Perform necessary field adjustments during the test period until the equipment installation and operation are satisfactory to the ENGINEER.
 - 5. Instruct OWNER's personnel in the operation and maintenance of the equipment. Instruction prior to system testing of the equipment shall include step-by-step troubleshooting procedures with all necessary equipment testing.
- C. Manufacture's Certificates:
 - 1. Provide equipment manufacturer's Certificate of Installation stating that the equipment is installed per the manufacturer's recommendations and in accordance with the Drawings and Specifications.
 - 2. Provide equipment manufacturer's Certificate of Performance stating that the equipment meets or exceeds the performance requirements as defined hereinbefore.

3.06 FACILITY STARTUP

- A. Startup of the facility shall be in accordance with Division 1 Section 01810 "Equipment Testing and Facility Startup." After initial startup under the supervision of a qualified representative of the manufacturer, a preliminary "running-in" period will be provided for the CONTRACTOR, per the Contract Documents, to make field tests and necessary adjustments.
- B. Place each piece of equipment in the system in operation until the entire system is functioning. All components shall continue to operate without alarms or shut downs, except as intended, for five (5) consecutive days to be considered started up.

- C. Operate the equipment through the design performance range consistent with available flows. Adjust, balance, and calibrate and verify that the equipment, safety devices, controls, and process system operate within the design conditions. Each safety device shall be tested for proper setting and signal. Response shall be checked for each equipment item and alarm. Simulation signals may be used to check equipment and alarm responses.

- D. Prepare manufacturer's installation report and submit within 30 days after completion of field testing. Including the following information:
 - 1. Field testing results.
 - 2. Descriptions of installation deficiencies not resolved to the manufacturer's satisfaction.
 - 3. Description of problems or potential problems.
 - 4. Names of the OWNER'S personnel who attended operations and maintenance training sessions.
 - 5. Record copy of materials used for training session including outlined summary of course.
 - 6. Manufacturer's Certificate of Installation and Certificate of Performance.
 - 7. At the end of the specified period of operation, the equipment system will be accepted if, in the opinion of the ENGINEER, the system has operated satisfactorily without excessive power input, wear, lubrication, or undue attention required for this operation, and if all rotating parts operate without excessive vibration or noise and the desired performance has been obtained.

END OF SECTION

Section 11085

CHEMICAL FEED EQUIPMENT

PART 1 GENERAL

1.01 WORK INCLUDED

- A. The contractor shall furnish, install, startup and test (1) calcium nitrate feed system and (1) ferrous sulfate feed system with all required accessories complete as shown on the plans and specified herein preassembled with piping connections and mounted on a framework suitable for attaching to the wall of a prefabricated fiberglass shelter. Each feed system shall be capable of metered pumping of chemicals from storage tanks to the point of application as shown on the plans. Each chemical system shall be equipped with a duty pump and a standby/redundant feed pump.

1.02 RELATED WORK AND SPECIFICATIONS

- A. Section 11017: Common Requirements For Chemical Feed Equipment Systems
- B. Section 13130: Pre-Fabricated Fiberglass Shelters
- C. Section 15100: Valves, Basic Requirements And Miscellaneous
- D. Section 15015: Piping System, Basic Materials and Methods.
- E. Division 16: Electrical.

1.03 QUALITY ASSURANCE

- A. The equipment manufacturer shall furnish a qualified field representative for a minimum of one (1) working day of eight (8) hours duration exclusive of travel to inspect all equipment described herein after installation, to assist in troubleshooting, to advise the OWNER during startup and testing, and to train OWNER's personnel in routine maintenance and troubleshooting procedures. OWNER may videotape training session.
- B. Manufacturer's installation report is required prior to final acceptance.
- C. All equipment of each type specified in this section shall be supplied by a single manufacturer. All chemical metering pumps shall be from one manufacturer.
- D. Manufacturer shall maintain a complete stock of spare parts commonly needed for the equipment specified at a location within the State of Texas.
- E. Each pump and motor shall be furnished with a stainless steel nameplate securely mounted to the body of the equipment. As a minimum, the nameplate for the pumps shall include the equipment number, manufacturer's name and model number, serial number, rated flow capacity, head, speed, and all other pertinent data. As a minimum, nameplates for motors and reducers shall include the motor or reducer number, manufacturer's name, and model number, serial number, horsepower, speed, reduction ratio, input voltage, amps, torque, number of revolutions per minute (pulses), and power and service factors.

- F. The pumps shall not differ from the basic requirements specified herein. Pumps differing from minor specified requirements may be accepted provided each point of difference is clearly stated in the shop drawings. This requirement is set forth to facilitate review of the shop drawings and is not to be construed by the CONTRACTOR or the Equipment Manufacturer as waiving any of the specified requirements.
- G. The equipment, sizes, materials, and arrangements described in this specification section are based on recommendations by equipment manufacturers and shall be considered minimum limits of acceptability. The equipment manufacturer shall be responsible for the performance of all equipment supplied under this section. Arrangements other than those shown on plans shall require owner's written approval.

1.04 SUBMITTALS

- A. Submittals shall be prepared and submitted for review in accordance with Section 01330. All deviations from contract documents shall be clearly identified and approved by the ENGINEER in writing.
- B. The following submittals are required at a minimum in addition to the applicable requirements of Section 01330.
 - 1. Shop drawings and applicable product data specific to this project shall be bound neatly in a single package. The following information shall be included as a minimum:
 - a. Manufacturer and model number of all equipment within this specification, and an itemized list of components being furnished.
 - b. Design performance characteristics, including, sizes, capacities, head, viscosity, and NPSH requirements over the operating ranges, and other appropriate information.
 - c. Layout drawings including all proposed system components with dimensions, clearances required and sizes indicated, arrangement and size of connections, and weights.
 - d. Schematic of chemical feed system identifying individual components in the system.
 - e. Listing of materials of construction, coatings, and chemical compatibility.
 - f. Complete information on all electric and instrumentation equipment and electric power requirements.
 - g. Complete wiring diagrams and data on controls and protection and monitoring devices to be furnished.
 - h. Manufacturer's instructions regarding delivery, storage and handling of equipment.
 - i. Complete operation and maintenance data for all major equipment and ancillary items in accordance with Section 01330.
 - j. Submittal of O&M Manuals shall be coordinated with Manufacturer's services so that final manuals are provided before classroom or site training begins.
 - 2. Startup and test schedule and procedures.
 - 3. Equipment installation report with field test data and test records.
 - 4. Location of nearest stocking distribution of spare parts with telephone number and a contact person.
- C. Any other information necessary for ENGINEER to determine compliance with the specifications.
- D. A list of similar installations including names and telephone numbers of contacts shall be furnished upon request.

E. Partial or incomplete submittals will not be reviewed by ENGINEER.

1.05 EXPERIENCE REQUIREMENTS

All equipment shall be the product of a manufacturer having at least fifteen (15) U.S. installations of the type being proposed, each with a minimum of five (5) years of satisfactory service.

1.06 DELIVERY, STORAGE AND HANDLING

Delivery, storage and handling shall be in full accordance with manufacturer's instructions.

1.07 EQUIPMENT WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chemical feed pump systems that fail(s) in materials or workmanship within specified warranty period.

C. Warranty Period: Three (3) years from date of Substantial Completion on pumps and appurtenances.

D. Cost for the removal, shipment, repair or replacement, and installation of components by CONTRACTOR shall be included in warranty, as well as replacement of defective work.

1.08 EXTRA MATERIALS

Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

A. Provide one set of spare parts as recommended by the manufacturer including, but not limited to, the following:

1. One 15-foot roll of each type of tubing furnished.
2. Two (2) seal and/or gasket kits for each pump.

B. Special tools necessary to maintain the equipment.

C. Other parts recommended by the manufacturer as typically needed in the first two years of operation.

PART 2 PRODUCTS

2.01 PERFORMANCE AND DESIGN REQUIREMENTS

A. All equipment including controls and drives specified herein shall be specifically designed for this service and the environment encountered in this installation. The environment may be moist, and corrosive. Refer to Section 11017.

B. Equipment shall be designed and capable of either continuous or intermittent operation.

C. All equipment, supports, anchors, and fasteners shall be of adequate strength to withstand loads associated with starting, turbulence, thrusts from liquid movement, thermal expansion, and contraction and other loads encountered under normal operating conditions.

2.02 GENERAL REQUIREMENTS

Provide a pumping system consisting of pump, gear reducer, motor, drive, pulsation accumulators and dampeners, leak detection system, pressure gauges/switches and other accessories as specified herein, regardless of manufacturer, as a complete integrated package to insure proper coordination and compatibility. Pump, variable frequency drive, and/or control panel will be rejected if not supplied by the pump manufacturer.

2.03 PERISTALTIC POSITIVE DISPLACEMENT TUBING PUMP

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Watson-Marlow Bredel Pumps; Series 500
 2. Blue-White Industries; FLEX-PRO M Series
 3. PeriFlow Chem TUFF; CT Series
- B. Pump Construction:
1. Enclosure: NEMA 4X, washdown/watertight/dustproof.
 2. Drive Case: Die cast aluminum with fusion bonded polyester coating or epoxy coated.
 3. Drive Head: Hinged guard door or one piece clear polycarbonate cover.
 4. Drive Shaft: Nickel plated carbon steel or stainless steel 440C.
 5. Rollers, Main/Guide: Stainless steel, two or three spring loaded tube clamp mechanism and roller assembly. One roller engaged providing tubing compression, preventing backflow or siphoning.
 6. Safety Interlock: Render drive inoperable when cover is opened.
 7. Speed Control: 2200:1 turndown, with 0.1 rpm resolution, 0.1% set speed accuracy.
 8. Speed Range: 0.1 rpm to 220 rpm.
- C. Motor: Brushless DC motor with the following:
1. Integral gearbox.
 2. Power Supply: 100-120V/200-240V, 1-phase, 50/60 Hz.
- D. Operating Requirements:
1. Self-priming when completely dry having suction lift capacity up to 30 feet of water.
 2. Flow, Pressure, and Liquid: Refer to Pump Schedule at end of this Section for the type of liquid to be pumped, flows, and pressures.
- E. Tubing:
1. Tubing shall be sized for the design flows and pressures, with material characteristics suitable for the liquids pumped.
 2. Material:
 - a. Compatible (with excellent rating) with chemical pumped.
 - b. NSF or FDA approved for use with drinking water.
 3. Tubing shall be replaceable with no disassembly of the pump head and without use of special tools.
- F. Control:
1. Keypad: Polyester, with glass-filled ABS plastic switch-plate.
 2. Pump Operation: Manual, remote, analog speed control, and digital network control.
 3. Security: Dual operator/supervisor PIN code protection of pump settings.
 4. Auto Control: Flow paced 4-20 mA signal from SCADA network.

2.04 ACCESSORIES

A. General:

Accessories listed below shall be furnished for each chemical feed pumping system.

1. Each peristaltic pump unit shall have a pressure relief valve.
2. Each peristaltic pumping system shall have the following accessories:
 - a. Calibration chamber with ball shutoff valve.
 - b. Pulsation chamber with ball shutoff valve.
 - c. Sight glass with streamers.
 - d. Pressure gauge with protective seal diaphragm and ball shutoff valve.
 - e. Back pressure anti-siphon valve.

B. Calibration Chamber:

1. Provide with ball valve on suction piping to each peristaltic pump.
2. Quantity and chamber volume according to the Table 1.

TABLE 1		
Calibration Chamber Requirements		
Chemical	Quantity	Chamber Volume (ml)
Calcium Nitrate	1	200
Ferrous Sulfate	1	500

C. Pulsation Dampener:

1. Single-diaphragm type pulsation dampener, with ball shutoff valve, shall be installed on the combined discharge lines.
2. Materials of construction compatible with chemical being pumped.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Milton Roy; Model PR-010.
 - b. Approved equivalent.

D. Pressure Relief Valve:

1. Install on each pump discharge line.
2. Adjustable between 10 and 50 psi. Set point 25 psi.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. LMI Model 35852.
 - b. Approved equivalent.

E. Sight Glasses:

1. Provide sight glass with streamers on each pump discharge line. Materials compatible with chemical pumped.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ryan Herco Model 5360.
 - b. Approved equivalent.

- F. Pressure Gauge:
 - 1. Provide pressure gauge for each pump system, complete with isolation valve, diaphragm isolation, liquid filled.
 - 2. Dial: 4-inch minimum.
- G. Y Strainer: GF Type 306
- H. Ball Valve: PVC True Union type. Refer to Division 15 Section 15100 "Valves, Basic Requirements and Miscellaneous."
- I. Equipment Identification Plates: A 16-gauge stainless steel identification plate shall be securely mounted on the equipment in a readily visible location. The plate shall bear 1/4-inch die-stamped equipment identification number indicated in the Chemical Pump Schedule and/or on the Drawings.
- J. Each pumping system with pumps, accessories, and piping connections shall be provided fully assembled and mounted on a support framework suitable for exposure to the chemicals pumped. Each framework shall be suitable for mounting on the wall of the chemical feed system shelter.

2.05 INSTRUMENTATION AND CONTROL

- A. General: Refer to Division 11 Section 11009 "Common Control Panel Requirements for Equipment" for general instrumentation and control requirements. All instrumentation, control and electrical components provided under this section shall comply with the requirements on the Drawings and Division 11, 16 and 17 Sections.
- B. Peristaltic Pumping Units Control:
 - 1. Local Control:
 - a. Metering pumps shall be equipped with auto/manual, pump speed, and forward/reverse switches on the pump. When the switch is set to the manual position; start, stop, pump direction, and speed are controlled at the pump.
 - 2. Remote Control:
 - a. Programming Responsibility: PLC program logic shall be by the chemical feed equipment supplier.
 - b. Remote Manual:
 - 1) Operator shall be able to manually start and stop the pumps from the PLC.
 - 2) Operator shall be able to manually set the speed of the pumps from the PLC.
 - c. Remote Auto:
 - 1) The SCADA system controls pump start/stop and speed. The Plant Operator sets the required chemical feed rate in gallons per hour.
 - 2) SCADA will be programmed to calculate a chemical flow rate based on a pump speed.
 - 3) SCADA will show for each chemical system; the chemical flow rates measured by the meters, the dose set points, and alarms.
 - 4) All control set points and alarms shall be set up for input/output to/from the SCADA system.
- C. Controls: Provide control system for each pumping unit, but not limited to, for monitoring the following instruments and controls. This list is not intended to completely depict all of the functional requirements of the control system provided.
 - 1. Controls mounted on panel face.
 - 2. Controls shall be mounted in a NEMA 4X stainless steel cabinet.

3. HAND/OFF/AUTOMATIC.
 - a. AUTO allows the unit to be started, stopped, or speed adjusted from the SCADA or remote control system.
 - b. HAND and AUTO settings will utilize the speed signal (4-20 mA) from the VFD.
 - c. RUN, ALARM, and OFF indicating lights.
 - d. ALARM reset.
4. Elapsed time meters for equipment.
5. Provide the following discrete outputs:
 - a. Pumping unit status.
 - b. Run contact and fail contact.
 - c. Leak alarm contact.
6. Provide the following discrete inputs:
 - a. Speed control.

2.06 SOURCE QUALITY CONTROL

- A. Testing and inspection of the factory assembled equipment shall be accomplished by manufacturer prior to shipment. Upon satisfactory completion of testing, the units will be disassembled into subcomponent assemblies for shipment and installation. At the manufacturer's option, the units may also be shipped to the site as complete units, providing said units can be installed as a complete assembly.
- B. All control panels shall be factory tested under simulated operating conditions verifying all devices function.
- C. Complete factory performance assurance testing shall be required prior to shipment.

PART 3 EXECUTION

3.01 GENERAL

- A. Install and adjust equipment in accordance with the Drawings, approved shop drawings, and the manufacturer's instructions. Do not operate the equipment until the manufacturer's representative approves the installation.

3.02 ASSEMBLY AND INSTALLATION

- A. Remove temporary bracing supports and other construction debris that may damage equipment. Remove protective coatings and oils used for protection during shipment and installation.
- B. Secure pump base to wall mounted support system with Type 316 stainless steel bolts sized as recommended by manufacturer.
- C. Comply with requirements for piping as shown on the Drawings and as specified in applicable Division 15 Sections. Support all piping independently of pumps. The general arrangement of piping, fittings, and specialties shall be as required to fit the space allowed in the FRP shelter.
- D. Complete equipment installation with controls, safety devices and auxiliary support systems necessary to start the equipment and verify that the equipment functions correctly under no load conditions.
 1. Turn rotating equipment by hand to check.
 2. Align equipment to Manufacturer's tolerances. Adjust clearances and torques.

CHEMICAL FEED EQUIPMENT

- 3. Complete cleaning and testing of piping systems. Inspect and clean equipment, devices, piping, and structures of debris and foreign material.
- 4. Check installation prior to start-up for conformance to Manufacturer's instructions.
- E. Install temporary connections and devices required to fill, operate, checkout and drain the system. Provide temporary valves, gauges, piping, test equipment, and other materials and equipment necessary to conduct testing and startup.

3.03 **FIELD QUALITY CONTROL**

- A. **Functional Tests:** Prior to plant startup, the CONTRACTOR, with the assistance of the manufacturer's representative, shall inspect all equipment for proper assembly and alignment, quiet operation, and proper operation.
- B. **Performance Test:** The manufacturer's representative shall conduct performance test on the equipment to certify compliance with the performance requirements.
 - 1. Place each chemical feed pumping system in operation. All components shall continue to operate without alarms or shut downs, except as intended, for eight consecutive hours to be considered started up.
 - 2. Operate through the design performance range consistent with available flows. Adjust, balance, and calibrate and verify that the pumping units, safety devices, controls, and control system operate within the design conditions. Each safety device shall be tested for proper setting and signal. Response shall be checked for each equipment item and alarm. Simulation signals may be used to check equipment and alarm responses.
- C. A copy of all information from functional tests, including data, worksheets, and other materials shall be turned over to the OWNER at the completion of the testing program.

3.04 **MANUFACTURERS' CERTIFICATES**

- A. Provide equipment manufacturer's Certificate of Installation stating that the equipment is installed per the manufacturer's recommendations and in accordance with the Drawings and Specifications.
- B. Provide equipment manufacturer's Certificate of Performance stating that the equipment meets or exceeds the performance requirements as defined hereinbefore.

3.05 **MANUFACTURER'S SERVICES**

- A. **Manufacturer's Representative:** Present at Project site or classroom designated by OWNER, for minimum person-days listed below, travel time excluded:

No. Person Days	Work Description
1/2	Installation assistance and inspection.
1/4	Functional and performance testing.
1/4	Pre-startup classroom or site training.
1/2	Facility startup.

- B. **Services Provided:**
 - 1. Furnish test forms and procedures for field-testing.
 - 2. Furnish startup services.
 - 3. Furnish training of OWNER'S personnel at such times requested by OWNER.

- C. OWNER may videotape training session.

3.06 FACILITY STARTUP

- A. Startup of the facility shall be in accordance with Division 1 Section 01810 "Equipment Testing and Facility Startup." After initial startup under the supervision of a qualified representative of the manufacturer, a preliminary "running-in" period will be provided for the CONTRACTOR, per the Contract Documents, to make field tests and necessary adjustments.
- B. Place each piece of equipment in the system in operation until the entire system is functioning. All components shall continue to operate without alarms or shut downs, except as intended, for 8 consecutive hours to be considered ready for start-up.
- C. Operate the equipment through the design performance range consistent with available flows. Adjust, balance, and calibrate and verify that the equipment, safety devices, controls, and process system operate within the design conditions. Each safety device shall be tested for proper setting and signal. Response shall be checked for each equipment item and alarm. Simulation signals may be used to check equipment and alarm responses.
- D. Prepare manufacturer's installation report and submit within 30 days after completion of field-testing. Including the following information:
 - 1. Field-testing results.
 - 2. Descriptions of installation deficiencies not resolved to the manufacturer's satisfaction.
 - 3. Description of problems or potential problems.
 - 4. Names of the OWNER'S personnel who attended operations and maintenance training sessions.
 - 5. Record copy of materials used for training session including outlined summary of course.
 - 6. Manufacturer's Certificate of Installation and Certificate of Performance.
- E. At the end of the specified period of operation, the chemical feed pumping and control systems will be accepted if, in the opinion of the ENGINEER, the systems operated satisfactorily without excessive power input, wear, lubrication, or undue attention required for this operation, and if all rotating parts operate without excessive vibration or noise and the desired chemical additions have been obtained.

3.07 PUMP SCHEDULE

- A. The Chemical Pump Schedule located after "END OF SECTION" is part of this Section.

END OF SECTION

CHEMICAL FEED EQUIPMENT

CHEMICAL PUMP SCHEDULE			
GENERAL			
Equipment Tag Number(s)	PMP-CN-1 & PMP-CN-2	PMP-FS-1 & PMP-FS-2	
Quantity	2	2	
Pump Name	Calcium Nitrate Feed Pumps	Ferrous Sulfate Feed Pumps	
Pump Manufacture	WMB	WMB	
Pump Model	520DuN/REL, L/S High Performance	520DuN/REL, L/S High Performance	
Location	Chemical Feed Enclosure	Chemical Feed Enclosure	
P&ID Dwg. No.	I-001	I-002	
SERVICE CONDITIONS			
Chemical/Solution	Calcium Nitrate	Ferrous Sulfate	
Liquid Temperature, °F	40 - 104	40-104	
Specific Gravity	1.45	1.19	
Explosion-proof (Y/N)	N	N	
Continuous Duty (Y/N)	Y	Y	
PERFORMANCE REQUIREMENTS			
Flow, gph (except as noted)	.01-5	.02-15	
Discharge Pressure, psig (except as noted)	5	5	
Suction Lift, feet of liquid	20	20	
Pump Speed, Maximum, rpm	220	220	
Constant Speed (Y/N)	N	N	
Adjustable Speed (Y/N)	Y	Y	
PUMP CONSTRUCTION DETAILS			
Enclosure Rating	NEMA 4X	NEMA 4X	
Bore Size, mm	Note 2	Note 2	
Wall Thickness, mm	Note 2	Note 2	
Materials	Note 1	Note 1	
Suction/Discharge, inches	1"	1"	
Power Supply	115/230 volts, US plug	115/230 volts, US plug	
Abbreviations: WMB = Watson-Marlow Bredel	NOTES: 1. Tubing material suitable for chemical handled. 2. Provide tubing size as required to meet the flows and pressures		

Odor Control Improvements for 11th St Bio-Scrubber Facility
WBS No. R-000020-0010-3 BIOLOGICAL TOWER-TYPE ODOR CONTROL SYSTEM

Section 11264

BIOLOGICAL TOWER-TYPE ODOR CONTROL SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. The SUPPLIER shall furnish, install, startup, balance, and test a complete Odor Control System (OCS), including foul air fans (Section 11330), biological tower-type odor control units (bio-scrubbers), appurtenances, instrumentation, and controls as specified herein and referenced sections of the specifications and the Drawings. The components of the OCS shall be furnished by a single supplier.
2. This section includes two (2) biological tower-type odor control units. Each biological tower-type odor control unit shall include the tower unit, irrigation system and mist eliminators, vessels or containers, inert inorganic media, valves, pumps, inlet air plenum, conduit, wiring, and control system.
3. The proposed system shall treat odors from the following locations in accordance with the requirements of this Section and the Drawings:
 - a. North Side Relief Tunnel Junction Chamber (as indicated on the Drawings);
 - b. 11th St Facility Wet Well Structure (as indicated on the Drawings);
4. To ensure system compatibility, a single SUPPLIER is responsible for the successful operation of each item of equipment and for the integrated system. The responsibility of the SUPPLIER shall include the approval of installation, system optimization, and warranties for the components and performance of the complete Odor Control System.
 - a. The responsibility of the Supplier shall also include providing hardware and ladder logic programming that conforms to City of Houston Standards.

B. Related Sections:

1. Division 1 Section 01330, "Submittal Procedures."
2. Division 1 Section 01755, "Starting Systems."
3. Division 9 Section 09901, "Protective Coatings."
4. Division 11 Section 11330, "Foul Air Fans."
5. Division 15 Section 15892, "Odor Control, Fiberglass Duct."

1.03 REFERENCES

- A. The following testing procedures shall be used to verify performance of the equipment, most current edition:
1. ASTM E679: Determination of Odor and Taste Threshold by a Forced-Choice Ascending Concentration Series Method of Limits.
 2. EN 13725: Air Quality – Determination of Odor Concentration by Dynamic Olfactometry.

1.04 SUBMITTALS

A. The following submittals are required.

1. Shop drawings specific to the project and applicable product data shall be bound neatly in a single package. The following information shall be submitted, as a minimum:
 - a. Manufacturer and model number of equipment.
 - b. Material Safety Data Sheets.

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- c. Layout drawings including all proposed system components with dimensions, clearances required and sizes indicated, anchor locations and sizes, details of ductwork or piping connections, size and location of required electrical conduits and conduit openings, and total weights of the product. Layout drawings shall be to scale in English units, provided on 11"x17" bond paper and on compact disk in AutoCAD format.
- d. Include flow directions, process information, loading rates, empty bed residence time, water requirements, etc., descriptions and provisions for adjustments and alarms on operating components. Indicate extent of shop fabrication and field joint types and locations.
- e. Detailed specifications and data describing the materials of construction, material thickness, linings, and coatings for all components.
- f. Submit data that verifies the system is capable of uniformly distributing flow throughout the system without short-circuiting and will meet the specified treatment requirements.
- g. SUPPLIER shall provide a list of similar installations with reference and contact information for operating systems. SUPPLIER shall have a minimum of five (5) successful installations of similar size for acceptance and shall have at least five (5) similar systems in continuous operation in similar applications for three (3) years. Submittals received without current names and phone numbers for reference contacts may be deemed non-responsive.
- h. Descriptions and characteristics of media, anticipated media life at design conditions and current replacement cost (material supply only) of media.
- i. Nutrients required for startup and operation, including concentrations and dosage rates, and range of operation.
- j. Empty bed residence times for range of operating flows.
- k. Headloss (inches of water column) through the bio-scrubber media, distribution plenum, and complete unit and odor control system over range of flows.
- l. All required utility connection points and supply requirements including power and water (quality, quantity, and pressure).
- m. Complete information on electric motors furnished including make and type of motor, brake horsepower and locked rotor current at full voltage.
- n. Complete electrical control schematic and wiring diagrams and data on equipment, devices and controls to be furnished, including support for control panel.
- o. Location and telephone number of nearest stocking distributor of spare parts.
- p. Startup and test schedule with test procedures.
- q. Equipment installation report with field test data and test records in accordance with Section 01330 (submit as record data after startup).
- r. Warranties and service agreements.
- s. All structural design calculations, drawings, and associated items shall be MANUFACTURER's responsibilities, and shall be including all scrubber vessels items, deflection of the vessel at the point of connection with the ductwork, thickness, anchor bolt size and location, hold-down lugs, lifting hooks, and loads imposed by appurtenances such as inlet and outlet ducting and internal media. The OWNER or OWNER'S Representative shall review the structural drawings and calculations for completeness only. All structural drawings and calculations shall be signed and stamped by a Professional Engineer (registered in the State of Texas) prior to submittal to the OWNER.
- t. Design of system shall be in accordance with applicable local, state, and national standards and codes.
- u. A certificate from the vessel manufacturer listing the nomenclature, composition, and characteristics of the resin or other plastics shall be supplied with the submittal data, as well as vessel and support calculations as specified if fiberglass is used for the scrubber vessel.
- v. Calculations for irrigation requirements, including recirculation rates.

- w. Any other information necessary for the OWNER or OWNER'S representative to determine compliance with the specifications.
 - 2. Instrumentation and Control Submittals:
 - a. P&IDs and Process Flow Diagrams.
 - b. Instrument specifications in ISA Format with catalogue cut sheets.
 - c. Instrument list with tag names, ranges, alarm set points, and manufacturer contact information.
 - d. Description of control system in written form including functions monitored, controlled, and alarmed. Include sequence of operation and interface requirements.
 - e. PLC Network Submittals:
 - 1) First Submittal
 - 1. PLC Input/Output List.
 - 2. PLC Hardware and software, Ethernet Switch, and Operator Interface Terminal (OIT) specifications with catalogue cut sheets.
 - 3. Control panel Layout with overall dimensions, Panel NEMA rating, Panel exterior color, and layout of external and internal mounted components.
 - 4. Submit heat dissipation calculations for every control panel listing all heat loads, appropriate ambient temperatures, and required cooling.
 - 5. Loop Diagrams.
 - 6. Interconnection wiring diagrams.
 - 7. PLC Soft link Input/Output List (Made available in Contiguous Registers) for Control/Owner's HMI.
 - 2) Second Submittal (Furnish as one single submittal)
 - 1. Hard copy of the PLC Application program (Programming software manual) with explanation of conventions used. Descriptions of the program functions shall be included to aid in understanding by Owner personnel.
 - 2. Soft Copy of the PLC Application program with comments on CD-ROM.
 - 3. Hard copy of Color graphics, alarm lists, reports & trends. Graphics must be approved by the Owner.
 - f. This submittal shall also include screen shots of all OIT graphic screens and complete PLC database including specific data register mapping required for the CS Integrator subcontractor to establish Ethernet mapping for remote monitoring and control as shown in the Drawings and specified herein.
 - 3. Complete Operation and Maintenance (O&M) Manuals shall be provided per Section 01782 and Division 1 requirements and shall include complete O&M information for all components of the system. O&M Manuals shall be submitted at least thirty (30) days prior to final acceptance of the system. In addition to standard information, the O&M manuals shall include:
 - a. Scrubber media handling information and safety data sheet, including replacement procedures.
 - b. Certification statement from manufacturer verifying that the media is nonhazardous.
 - c. Fan sizing calculations. These shall include calculations of pressure loss through the proposed synthetic media, and losses through the system.
 - d. Complete point-to-point wiring diagrams. Complete component bill of material with manufacturers catalog cut sheets marked to show components provided.
 - e. Submit copies of final PLC and OIT program versions in native format.
 - f. Training video in a format approved by the Owner for the odor control equipment components.
- B. Partial or incomplete submittals will not be reviewed. Any exceptions from this specification shall be itemized in an exceptions table.

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1.05 QUALITY ASSURANCE

- A. The MANUFACTURER shall provide an installation report prior to final acceptance. In addition to the requirements of Section 01330, the equipment installation report shall state that biological treatment system is achieving the specified removal efficiencies. Test data on the installed system shall be included in the report.
- B. All equipment of each type specified in this section shall be supplied by a single OCS Supplier and shall be the product of manufacturers regularly engaged in the design and manufacturing of biological odor scrubbing equipment. The OCS SUPPLIER, in coordination with the Foul Air Fans manufacturer(s) shall be responsible for supplying a complete functioning system.
- C. MANUFACTURER shall maintain a complete stock of spare parts commonly needed for the equipment specified at a location within 500 miles of Houston, Texas or shall be able to deliver the spare parts within 48 hours of notification.
- D. All pieces of equipment shall have a stainless steel manufacturer's nameplate securely affixed in a conspicuous place on the equipment showing the ratings, serial number, model number, manufacturer and other pertinent nameplate data.
- E. Upon completion of the installation, each piece of equipment and the system shall be tested for satisfactory operation without excessive noise, vibration, overheating, etc. All equipment must be adjusted and checked, for misalignment, clearances, supports, and adherence to safety standards. Excessive vibration or noise from equipment while operating will be cause for rejection of equipment.
- F. Performance testing shall be conducted as specified herein, and per Section 01755, "Starting Systems."
- G. Post installation Inspection: MANUFACTURER shall provide a field representative to inspect the system eleven (11) months after substantial completion of the entire project and shall submit an inspection report within seven (7) calendar days of each inspection.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Delivery, storage and handling shall be in full accordance with MANUFACTURER'S instructions. Fabricated assemblies shall be shipped in the largest sections permitted by carrier regulations, properly match-marked for ease of field erection.

1.07 INITIAL SUPPLY OF CONSUMABLES

- A. MANUFACTURER shall furnish and indicate types, brands, and quantities of initial lubricants, oil, grease, nutrient solutions, biological seeding material, etc. necessary to startup equipment. MANUFACTURER shall provide and install the recommended lubricants and shall comply with all manufacturer recommended procedures.
- B. If nutrients are required for operation, MANUFACTURER shall provide a one-year supply (beginning at acceptance of the odor control unit) of nutrients in addition to supplies for startup and testing.

1.08 WARRANTY

- A. Special Equipment Warranty: Refer to Division 1 for Special Equipment Warranty requirements. Additional warranty requirements are listed below.
- B. Media: Special media warranty shall be for ten (10) years from final acceptance of the odor control equipment and shall provide for complete replacement of the media, including equipment, materials, labor, freight, and any and all costs associated with washing, replacing or regenerating the media as needed. Media failure includes increase in pressure drop through the media such that the specified airflow rates are not achievable with the installed equipment.

Odor Control Improvements for 11th St Bio-Scrubber Facility

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PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with all specified requirements, available manufacturers offering products include the following:
1. BioAir Solutions, LLC
 2. Engineered Composite Systems
 3. Evoqua Water Technologies
 4. Daniel Mechanical Company
 5. Met-Pro Environmental Air Solutions (Bio-Pro System)
 6. or Approved Equal

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

- A. Source Characteristics for the 11th Street Facility: Expected odorant composition is given in Table 1.

TABLE 1: PERFORMANCE AND DESIGN REQUIREMENTS

Foul Air Parameters	Value or Range
Foul Air Flow Rate	<u>Typical Operation:</u> 25,000 cubic feet per minute (cfm) (total); 12,500 cfm (per unit)
Average Inlet Hydrogen Sulfide Concentration Range	25-50 parts per million (ppm)
Inlet Hydrogen Sulfide Concentration Transient Peak	200 ppm
Other Inlet Odorants	Reduced Sulfides, VOCs, Amines
Ambient Air Temperature	0-115°F
Empty Bed Residence Time (EBRT)	10 seconds, minimum at Typical Operating Condition
Maximum Pressure Drop (from inlet to outlet flanges)	6.5 inches w.c., maximum

- B. Removal requirements:

1. Refer to Paragraph 3.3 of this Section for additional performance testing requirements.
2. Biological Tower-Type Odor Control System Guarantee (at the Typical Operating Condition):
 - a. Average H₂S Removal: Minimum ninety-nine percent (≥99%) of inlet hydrogen sulfide, or the outlet concentration shall be less than 0.1 ppm, whichever is higher.
 - b. Average Odor Removal: For inlet dilution-to-threshold (D/T) concentrations, minimum ninety-percent (≥90%) odor removal is required, or the outlet D/T shall be less than 60 DT, whichever is higher. For influent odors with D/T concentrations equal to or greater than the laboratory's maximum value of 60,000, the sample may be diluted with nitrogen gas (per laboratory recommended procedures) to obtain measureable values.

BIOLOGICAL TOWER-TYPE ODOR CONTROL SYSTEM WBS No. R-000020-0010-3

2.03 BIOLOGICAL TOWER-TYPE ODOR CONTROL SYSTEM

A. The MANUFACTURER shall:

1. Supply all materials and equipment exposed to the airstream, condensate, or leachate with protection from corrosion damage. Corrosion resistant materials and equipment are required unless specifically permitted in this section.
2. Provide all hardware, anchors, embedded anchors, and miscellaneous metals that are Type 316 stainless steel.
3. Obtain approval from the OWNER or OWNER's representative for all coatings to be used in the completed installation. Coatings shall be in accordance with Section 09901, where applicable.
4. Provide an odor control system that operates using biological processes and does not rely on carbon either integrated within the media or as a polishing stage for meeting the specified performance for the biological tower-type odor control system.
5. Provide sampling ports (minimum 1/2-inch diameter) for the inlet, exhaust and a minimum of one (1) intermediate stages to measure airflows and airstream constituents. Ports shall be easily accessible by OWNER'S personnel and shall be routed to ground level. Provide a pressure gauge to measure the pressure in the distribution plenum at the base of the scrubber unit. Sample ports routed to ground level shall include a drip leg with ball valve. Provide a ball valve on the end of the sample line.
6. Provide sample ports with ball valves on condensate and leachate drains to measure pH. Ports shall be easily accessible by OWNER's personnel. Provide pH probes in the locations as designated on the Drawings.
7. CONTRACTOR shall heat trace, insulate, and aluminum jacket all exposed water lines. Valves and appurtenances shall also be insulated and heat traced.
8. All drains from a pressure area shall include a trap with cleanout to be provided by MANUFACTURER. Trap shall contain a depth of water sufficient to prevent escape of foul air from the system.

B. Vessel Requirements

1. All materials used in the vessel shall be inherently corrosion resistant or shall have a corrosion resistant coating. Design drawings for vessel(s) shall be sealed by a licensed engineer registered in the State of Texas.
2. Acceptable materials include:
 - a. Fiberglass Reinforced Plastic (FRP) vinyl ester resin in accordance with ASME RTP-1.
 - 1) Provide a gel coat on all surfaces and UV inhibitor on all external surfaces.
 - 2) Submit certificate from the vessel manufacturer listing the nomenclature, composition, and characteristics of the resin, as well as vessel and support calculations.
 - b. Grade 316L stainless steel.
 - c. Hastelloy C.
 - d. Other materials may be utilized on a case-by-case basis subject to approval by OWNER and its ENGINEER.
3. Design of system shall be in accordance with applicable local, state, and national standards and codes. Provide an aluminum or FRP ladder with cage and landings fastened to each scrubber used to access the exhaust stack.
4. Tank shall meet the following loading criteria:
 - a. Wind load limit when anchored: 130 mph.
 - b. Concentrated top load limit: 250 lb. on a 16 square inch area.
 - c. Seismic zone: 0.

C. Irrigation system: The system shall include an irrigation system.

1. Irrigation system shall provide water for biological activity. Irrigation shall be monitored and controlled by PLC, as appropriate for the Manufacturer's process.

2. Indicate in the submittal what the water requirements are for operation, including water type (potable/non-potable) and maximum instantaneous flow rate in gpm. Provide an in-line filter or strainer on the water supply line.
- D. Particulate removal: MANUFACTURER'S design shall consider particulates such as wind-blown dust that may be present in the airstream and shall provide for their removal if equipment performance shall be hampered by their presence.
- E. Comply with the requirements of Division 9 Section 09901, "Protective Coatings."

2.04 INSTRUMENTATION, CONTROL AND ELECTRICAL COMPONENTS

- A. All instrumentation, control and electrical components provided under this section shall comply with the requirements on the Drawings and Division 11 and 16 Sections.
- B. Control Panel
 1. General: Refer to Section 11009 "Common Control Panel Requirements for Equipment" for the general requirements of the Control Panel. Provide control system for equipment system, including but not limited to, for monitoring the following instruments and controls. This list is not intended to completely depict all of the functional requirements of the control system provided under this Section. The system supplier shall provide all additional instrumentation and controls necessary to produce a safe and operable system.
 2. The panel shall include the following controls mounted on panel door;
 - a. Run and fail status for each piece of equipment
 - b. Start/stop push buttons for each piece of equipment.
 - c. HOA switches for each piece of equipment.
 - d. Fail reset button for each piece of equipment
 - e. Elapsed run time meter for each piece of equipment.
 - f. Operator Interface Panel
 3. Panel shall communicate to Control System via Ethernet.
 4. Recirculation Pump Starter
 5. Panel shall be provided with air conditioning.
- C. Functional Requirements
 1. The following sequence of the operation is provided to establish a basic level of detail and complexity for the system. Individual manufacturer's recommendations for their specific machine settings will be taken into consideration during the shop drawing review process.
 2. The bio-scrubber system may be operated in the automatic mode by placing the HAND/OFF/AUTO selector switch within the OIT in the AUTO position. The AUTO MODE indicator shall be illuminated on the OIT and the PLC shall control the bio-scrubber system equipment automatically as defined by the system supplier.
 3. To operate the bio-scrubber system in the manual mode, the operator shall place the HAND/OFF/AUTO selector switch in the HAND position on the OIT. The HAND MODE indicator shall be illuminated on the OIT. The operator shall control the bio-scrubber system equipment manually via pushbuttons on the OIT.
 4. Positive status shall be wired back in the form of discrete contracts from field equipment or starters. A piece of equipment shall be considered failed if it is requested to START, STOP, OPEN, or CLOSE and the PLC does not receive proper feedback after an adjustable period of time.
 5. The PLC-based control functions at the MCP shall include control and operator interface capability plus pass-through to the control system for remote control and monitoring of position, speed, running status, and failure status for each piece of equipment.
 6. The Foul Air Fans shall be directly controlled by hardwired I/O and logic from the PLC in the Odor Control System MCP.

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D. Field Instrumentation

1. Instruments shall include, but not be limited to pH probe(s), pressure gauge(s), level switch(es), water flow meter(s), and differential pressure sensor(s).

E. Sequence of Operation

1. The following sequence of the operation is provided to establish a basic level of detail and complexity for the system. Individual manufacturer's recommendations for their specific machine settings will be taken into consideration during the shop drawing review process.
2. The bio-scrubber system may be operated in the automatic mode by placing the HAND/OFF/AUTO selector switch within the OIT in the AUTO position. The AUTO MODE indicator shall be illuminated on the OIT and the PLC shall control the bio-scrubber system equipment automatically as defined by the system supplier.
3. To operate the bio-scrubber system in the manual mode, the operator shall place the HAND/OFF/AUTO selector switch in the HAND position on the OIT. The HAND MODE indicator shall be illuminated on the OIT. The operator shall control bio-scrubber system equipment manually via pushbuttons on the OIT.
4. Positive status shall be wired back in the form of discrete contracts from field equipment or starters. A piece of equipment shall be considered failed if it is requested to START, STOP, OPEN, or CLOSE and the PLC does not receive proper feedback after an adjustable period of time.
5. The PLC-based control functions at the MCP shall include control and operator interface capability plus pass-through to the control system for remote control and monitoring of position, speed, running status, and failure status for each piece of equipment.

2.05 CONTROL DESCRIPTION

A. General

1. The Odor Control System is a stand-alone control system monitored by the Control System. The MCP provides supervisory and automatic control through the panel's OIT and physical switches and is used by the Plant Operators to make adjustments to foul air fan and bio-scrubber controls.
2. All control actions at the Odor Control MCP are performed using the Odor Control PLC. To prepare for the Odor Control System to run, the Operator shall make selections from the following equipment and control options:
 - a. Odor Control Foul Air Fan (Select one of the two supply fans for each specified location).
3. To the run the Odor Control System from the MCP, all equipment controlled by the Odor Control System must have their Local/Remote switches on their Local Control Panels in the Remote position and applicable VFD/MCC Hand/Auto switches in the Auto position.

2.06 SPARE PARTS

A. The following spare parts shall be provided:

1. One (1) set of special tools required for maintenance or adjustment.
2. Two (2) sets of fuses of each type used.
3. Two (2) spare relays of each type used.
4. One (1) spare bulb of each type used on panel fronts.
5. One (1) spare water panel strainer element.
6. Other items as recommended by the Manufacturer and Supplier.

PART 3 EXECUTION

3.01 FABRICATION AND FACTORY TESTING

- A. The procedure shall consist of the Test Plan submittal and the Testing, and shall comply with Section 01755, "Starting Systems." In the Test Plan submittal, the approach to testing is stated

- along with a description of the general approach to testing all functions. This plan gives the reader a good idea of how the testing will be conducted. The details of the testing are in the Testing Sections. The Test Plan submittal shall include the following:
1. Purpose
 2. References
 3. Test Environment Statement
 4. Procedure
 5. Test Section Checklist
- B. The body of the Factory Testing is split into sections around similar functional test areas. The sections contain a minimal amount of description of the testing with the great majority dedicated to recording the data. Each section includes the following:
1. Test Number.
 2. Test Purpose.
 3. Acceptance Criteria.
 4. Detailed Test Procedure.
 5. Data Collection Portion of the Form.
 6. Comments Section.
 7. Signature Block.
 8. Date Block.
 9. Approval Block.
- C. All major system controls for the Odor Control System shall be factory tested for compliance with the construction and functional requirements specified herein and a report of the results of these tests shall be submitted in writing to the Engineer for each control panel separately, prior to shipment. All PLC and OIT programming shall be performed at the factory. Certification of test results shall be submitted to the Owner and Engineer. Factory testing shall consist of an Unwitnessed Factory Test (UFT). Supplier shall notify the Engineer and Owner of the successful completion of the UFT. Examples of testing sections are as follows:
1. Panel wiring.
 2. Panel power on operational test.
 3. I/O check from panels through the software.
 4. Testing of manual operations.
 5. Testing of functional modules of programming (automatic and sequencing).
 6. Trending and Alarm verification.
 7. Security.
 8. Power loss and restoration.
 9. OIT and graphics shall be tested.
- D. Successful completion of UFT and approval of PLC programming by the Engineer are required prior to shipment of the PLC. Retainage of payment shall be withheld until successful completion of UFT and approval of PLC programming as described herein.

3.02 MANUFACTURER'S SERVICES

- A. Manufacturer's services shall comply with the requirements of Division 1 Section 01755 "Starting Systems."
- B. Submittal of O&M Manuals shall be coordinated with Manufacturer's services so that final manuals are provided before classroom or site training begins.
- C. The MANUFACTURER shall furnish a qualified startup engineer or field representative to provide guidance with installation. The field representative shall also inspect all equipment described herein after installation, assist in troubleshooting, advise the CONTRACTOR during startup, balancing, and testing, and instruct OWNER's personnel in routine maintenance and troubleshooting procedures. Working days shall consist of eight-hour (8-hr) days, exclusive of travel time. The MANUFACTURER shall coordinate the scheduling of such training and startup assistance with OWNER'S personnel. OWNER may videotape training session.

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- D. Manufacturer's Representative: Present at Project site or classroom designated by OWNER, for minimum person-days listed in Table 2, travel time excluded:

TABLE 2: MANUFACTURER'S SERVICES

Work Description	No. Person Days	No. Trips
Installation assistance and inspection	1	1
System balancing and functional and performance testing	1	Can be combined with training
Pre-startup classroom or site training	1	1
Facility startup	1/2	Can be combined with training
Follow up visit 11 months after substantial completion for inspection and training	1	1

3.03 START-UP, BALANCING, AND ACCEPTANCE TESTING

- A. Startup of the odor control system shall be done in accordance with MANUFACTURER'S recommendations and as specified in Section 01755, "Starting Systems."
- B. Each portion of the OCS shall be tested as specified herein and as indicated in Division 1. The OCS shall be sampled at the intake of each bio-scrubber and at each bio-scrubber unit discharge.
- C. In the presence of the OWNER and the OWNER's engineer, CONTRACTOR shall adjust and balance the odorous air flow in the complete foul air collection system. Requirements include measurement and establishment of the air quantities and pressures as required to meet design Specifications, and recording and reporting the results.
- D. In the presence of the OWNER and the OWNER's engineer, CONTRACTOR shall test the operation of the odor control system. Final acceptance shall not be made until after successful completion of the performance testing and receipt of the final installation report.
- E. Testing Equipment: CONTRACTOR shall supply the equipment listed below for the duration of the performance testing. Equipment shall remain on site until performance testing has been accepted by the OWNER or OWNER'S representative. Submit current calibration certificates for each piece of equipment used along with test results. CONTRACTOR shall comply with equipment manufacturer's recommendations for equipment use.
1. Odalog Hydrogen Sulfide Gas Logger by Detection Instruments. One Range 0-1000 ppm Odalog; two low-range 0.001-2.0 ppm Odalogs; one Low-Range Sampling System (LRSS-2) and one Multiple Odalog Sampling System (MOSS-2) unit, each with sufficient PVC or Teflon hose for testing.
 2. Alnor AXD 540 Micromanometer by TSI Incorporated, Range 250-15,500 fpm, with 18-inch pitot tube and hoses, or acceptable equivalent.
 3. Accuro gas detector pump by Drager Safety. Include 10 tubes for Hydrogen Sulfide 0-2000 ppm.
 4. Odor sampling shall commence one hour after the H₂S monitoring equipment has been installed and is determined to be stable. Two (2) sample sets, each consisting of the bio-scrubber inlet and bio-scrubber discharge from each pair of treatment units shall be taken, each sample set taken one hour apart. The inlet and outlet samples for each treatment unit shall be taken concurrently and the sampling time and inlet and outlet H₂S levels logged in the field prior to shipment. The samples shall be shipped to the laboratories for analysis to be received within 24 hours. The analyses and respective laboratories shall include:

5. ODOR UNITS TESTING:
St. Croix Sensory
1150 Stillwater Blvd. North
Stillwater, MN 55082
1-800-879-9231

6. REDUCED SULFIDES TESTING:
ALS Environmental (formerly Columbia Analytical Services, Inc.)
2655 Park Center Drive, Suite A
Simi Valley, CA 93065
805-526-7161

- F. Adjusting, Balancing, and Testing Procedure:
 1. The OCS shall be adjusted and balanced prior to testing. This process shall include:
 - b. Adjusting the air flow rates from the specified foul air sources (e.g., reduce fan speed, throttling with damper adjustments).
 - c. Balancing the system to proportion flows within the distribution system (sub mains, branches, and terminals) according to specified design quantities.
 2. Measure the airflow velocity (feet per minute(fpm)), static pressure (inches water column (in. wc)), and velocity pressure (in. wc) into each odor scrubber/adsorption unit. Airflows shall be within five percent (5%) of the specified value before testing may commence.
 3. Measure the airflows into each individual scrubber/adsorption unit. Airflows shall be within 5% of equal or specified distribution before testing may commence.
 4. Using the Draeger pump and H₂S tubes, verify the inlet H₂S concentration is less than 1,000 ppm.
 5. Connect the low range Odalog LRSS-2 tube to the exhaust of each scrubber/adsorption unit being tested. Connect the high range (0-1000 ppm as appropriate) Odalog MOSS-2 tube to the foul air collection system at the inlet of the bio-scrubber(s) being tested. Coordinate sampling locations with the OWNER or OWNER'S Representative. Odalogs shall be set to log time, temperature (°F) and H₂S concentration at two-minute intervals, maximum. Log data continuously for a minimum of two weeks for each pair of scrubber/adsorption units. Comply with the Odalog manufacturer's instructions and recommendations for use. Odalogs must be logging data during the duration of the tests. Testing shall comply with Section 01755, "Starting Systems," and Division 1.
 6. Using the low-range Odalogs, log bio-scrubber exhaust H₂S concentrations at maximum two-minute intervals.

- G. Testing Report: CONTRACTOR shall submit the following:
 1. CD-ROM containing the original Odalog data files and files exported into Microsoft Excel format. Written report shall include graphs of Odalog data.
 2. Dimensioned drawing showing locations and identification of samples taken.
 3. Date, time, sample and results of each sample taken.
 4. Airflow rate, static and velocity pressures at the time of sampling.
 5. Any deviations from the test procedure with an explanation.
 6. Original log of sample information including but not limited to duration of each sampling event and overall performance test, equipment type used for each sampling event, type of constituent measured in each sampling event.

- H. Acceptance: Determination of satisfactory performance will be made by the OWNER or OWNER'S representative based on the above performance testing or additional testing as needed. Acceptable H₂S removal will be determined by averaging the continuously logged inlet H₂S concentrations and averaging the continuously logged outlet concentrations measured by the Jerome meter or Odalogs, as appropriate. Odor sampling shall be performed in accordance with ASTM E679 and EN 13729. If the sampling results do not meet the requirements of Paragraph 2.2, Item B of this Section, the MANUFACTURER will be given four weeks to make necessary modifications to the odor control system before a retest is conducted at no expense to the

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- OWNER. The OWNER may withhold the cost of any retest from the CONTRACTOR's final payment. If the system fails two retests, the MANUFACTURER shall remove and replace the odor control system with one that meets the requirements, at its sole cost.
- I. MANUFACTURER may conduct concurrent testing at their option at no cost to the OWNER. Concurrent testing by the MANUFACTURER will not be used as a basis for unit acceptance.
 - J. All warranty and guarantee periods shall be in accordance with Division 1 and Paragraph 1.08 of this Section. Performance testing may not begin until the system is connected to all the foul air sources listed in Paragraph 1.02, Item A.3 of this Section.

END OF SECTION

Section 11330

FOUL AIR FANS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Coordinating Supplier:

1. The SUPPLIER of the Biological Tower-Type Odor Control System (Section 11264) shall be responsible for providing all equipment listed in this specification section.

B. Section Includes:

- a. The SUPPLIER shall furnish, provide installation guidance, startup, and test two (2) foul air fans with variable frequency drives (VFDs), as shown in the Drawings, and as specified herein for a complete and operable system. Each foul air fan unit shall include all equipment components, materials, accessories, wiring, control system (compatible with the Plant Control System (PCS)), and incidentals as required for functional equipment, excluding ducts or dampers.
- b. To ensure system compatibility, a single SUPPLIER is responsible for providing a complete odor control system, the successful operation of each item of equipment in the package, and for the integrated system which also includes Biological Tower-Type Odor Control Systems (Section 11264) and Carbon Adsorber Odor Control Systems (Section 11265). The responsibility of the SUPPLIER shall include the approval of installation, system optimization, and warranties for the components and performance of the complete Odor Control System.

C. Related Sections:

1. Division 1 Section 01330, "Submittal Procedures."
2. Division 1 Section 01755, "Starting Systems."
3. Division 9 Section 09901, "Protective Coatings."
4. Division 11 Section 11009, "Common Control Panel Requirements."
5. Division 11 Section 11005, "Common Motor Requirements."
6. Division 11 Section 11264, "Biological Tower-Type Odor Control System."
7. Division 16, Section 16269, "Variable Frequency Drives."

1.03 REFERENCES

- A. Reference Standards: This Section contains references to the following documents. They are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail. Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.

1. AFBMA, Anti-Friction Bearing Manufacturers Association.
2. AMCA 210-97/ASHRAE 51-1985, Laboratory Methods of Testing Fans for Rating.

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3. AMCA 300, Reverberant Room Method for Sound Testing of Fans.
 4. ASHRAE 51-1985 Laboratory Methods of Testing Fans for Rating.
 5. ASTM C 582, Specification for Contact-Molded Reinforced Thermosetting Plastic Laminates for Corrosion Resistant Equipment.
 6. ASTM D 2563, Practice for Classifying Visual Defects in Glass reinforced Plastic Laminate Parts.
 7. ASTM D4167-97 (2002), Standard Specifications for fiber-Reinforced Plastic Fans and Blowers.
 8. IEEE 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
 9. NEC, National Electric Code.
 10. NEMA, MG1 - Motors and Generators.
 11. NFPA, National Fire Protection Association.
 12. SSPC, Steel Structures Painting Council.
 13. Underwriter's Laboratories, Inc.
 14. AMCA 211-94, Certified Ratings Program – Air Performance
 15. ANSI/AMCA 204-96, Balance Quality and Vibration Levels for Fans
- B. Inspection and Testing Requirements: The visual inspection of the equipment shall comply with ASTM D 2563, Visual Acceptance Level II.
- C. Listing, labeling or marking, as conforming to the standards of AMCA, Underwriter's Laboratories, Inc., American National Standards Institute, Inc., or other nationally recognized testing organization approved by Code, on various pieces of equipment furnished shall be prima facie evidence of conformity with the approved standards for safety to life and property.

1.04 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. MANUFACTURER shall submit for review to OWNER or OWNER'S representative, sufficient literature, detailed specifications, and drawings to show dimensions, fabricator or manufacturer, speed, model, size, type, horsepower, service factors, efficiency, materials used, design features, internal construction, weights, and any other information required by OWNER or OWNER'S representative for review of odor control fans and all appurtenances. No odor control fan equipment shall be accepted, and installation shall not be allowed until such review has been completed.
 2. Additional requirements for information to be included with Shop Drawings are specified below:
 - a. Submittal for the odor control fans shall include as a minimum the following:
 - 1) Manufacturer's certified rating data.
 - 2) Certified Shop Drawings providing all important materials and details of construction, dimension, and anchor bolt locations. (w/ FINAL PRINTS AFTER APPROVAL).
 - 3) Descriptive literature, bulletins, and catalogs of the equipment.
 - 4) The total weight of the equipment.
 - 5) A complete bill of materials.
 - 6) A list of the manufacturer's recommended spare parts. Include

gaskets, packing, etc., on list.

- 7) Complete data on motors, motor starters, nameplate data and controls.
- 8) Data on noise in accordance with AMCA #300.
- 9) Description of surface preparation and shop primer and shop finish coating as specified in this Section.
- 10) Inlet and outlet connection bolt hole patterns.
- 11) Results of factory dynamic balance of fan and field check of dynamic balance of fan.
- 12) Complete electrical wiring diagrams and data on controls to be furnished, as pertinent.
- 13) Specific design parameters for this project including flow rates and pressure losses for normal conditions. Include AMCA certified blower curves showing efficiency, cfm, outlet velocity, static pressure, brake motor horsepower, and decibel level ratings.

B. Shop Test Results:

1. Submit results of routine factory motor tests.
2. Submit results of material tests.

C. Field Test Results: Submit a written report providing the results of the required field tests per Paragraph 1.5, Item K of this Section.

D. Manufacturer's Reports: Submit a written report of the results of each visit by a manufacturer's service person, including purpose and time of visit, tasks performed and results obtained.

E. Operation and Maintenance Manuals: Submit complete installation, operation and maintenance manuals, test reports, maintenance data and schedules, description of operation, and spare parts information.

F. Lubricant Specification: Furnish a lubricant specification for the type and grade necessary to meet the requirements of the equipment.

G. Partial or incomplete submittals shall not be reviewed. Any exceptions from this specification shall be itemized in an exceptions table.

1.05 QUALITY ASSURANCE

A. The MANUFACTURER shall provide an installation report prior to final acceptance. In addition to the requirements of Section 01302, the equipment installation report shall state that the treatment system is achieving the specified removal efficiencies. Test data on the installed system shall be included in the report.

B. Odor Control Fan Manufacturer's Qualifications: Equipment Supplier shall supply a fan from a manufacturer that has a minimum of five (5) years of experience of producing similar equipment and shall be able to show evidence of at least five installations, of the same size and type, in satisfactory operation for at least five years.

C. Materials Testing: Materials employed in items fabricated of fiberglass reinforced plastic shall be capable of withstanding maximum calculated stresses that may occur during fabrication, installation and continuous operation, with allowance for an adequate safety factor. To confirm materials properties, tests shall be conducted by an independent, qualified testing laboratory on representative material samples in accordance with the latest revision of Standards referenced in Paragraph 1.3.B, above.

D. Products supplied under this Section shall be produced by manufacturers regularly engaged in the production of such items and have a successful history of product acceptability, as interpreted

- by OWNER or OWNER'S representative.
- E. When two or more units of equipment for the same purpose are required they shall be the product of one MANUFACTURER.
 - F. MANUFACTURER'S installation report is required prior to final acceptance.
 - G. Excessive vibration of equipment while operating shall be cause for rejection. This is based upon "IN" readings on the fan bearings at installation fan rpm per the requirements of Fan Application Category BV-3 of AMCA ANSI Standard 204-96. If Final Trim Balancing is required it is the responsibility of the SUPPLIER to have this done by a MANUFACTURER approved Vibration Specialist.
 - H. MANUFACTURER shall maintain a complete stock of spare parts commonly needed for the equipment specified at a location within 500 miles of Lubbock, Texas, or shall furnish spare parts within 48 hours of request.
 - I. Each major equipment item shall have an engraved stainless steel MANUFACTURER'S nameplate securely affixed in a conspicuous place on the equipment showing the ratings, serial number, model number, MANUFACTURER and other pertinent nameplate data.
 - J. If the equipment being offered differs from these specifications, all revisions in the design and construction of the structure, piping, appurtenant equipment, electrical work, etc. required to accommodate such a substitution shall be made at no additional cost to the OWNER.
 - K. Factory Test Reports with curves, vibration, sound, pressure, and bearing analyses shall be provided by the MANUFACTURER (AMCA 210 and 300).
- 1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING
- A. Product Delivery, Storage and Handling:
 - 1. SUPPLIER shall be responsible for safe transportation, storage, and handling of the equipment.
 - 2. MANUFACTURER shall protect all flange faces and the more fragile appurtenances of the sub-assemblies, with padding between pieces in order to prevent one piece from impacting with another, and by crating or other means for shipment.
 - 3. Large sub-assemblies shall be supported during unloading to prevent excessive deflection and overstressing.
 - 4. Suction and discharge ports shall be protected against entry of foreign objects.
- 1.07 EQUIPMENT INSPECTIONS
- A. A thorough inspection of each piece of equipment shall be conducted by the CONTRACTOR upon arrival at construction site to inspect for damage incurred in transit. Any damage shall be immediately repaired by respective equipment fabricator's personnel, not a sales representative, or the equipment shall be returned to the SUPPLIER.
- 1.08 EQUIPMENT FABRICATION
- A. FRP equipment and accessories shall be fabricated in a heated and well ventilated structure protected from weather and temperature extremes. Entire fabrication, curing and assembly process of any piece of FRP equipment shall be indoors. SUPPLIER shall submit an affidavit certifying that all FRP equipment shall be fabricated, cured and assembled as described in this Section and in accordance with the manufacturer's recommendations.
- 1.09 EQUIPMENT DEFECTS
- A. Equipment that has mechanical defects and does not meet manufacturer's vibration requirements shall be rejected and shall be replaced at MANUFACTURER'S full expense for furnishing,

- installing, removal, and replacement.
- B. Mechanical defects shall include excessive vibration, improper balancing of rotative parts, improper tolerances, binding, excessive bearing heating, defective materials, improper fitting of parts, and any other defect which shall in time damage the equipment or impair its operation.
 - C. Requirements must be met concerning minimum and maximum dimensions and the specifications for materials. If it is found upon delivery that materials do not agree with the requirements of these Specifications as to materials, size, type, quality, or metallurgy, they shall be rejected as unfit for use.

1.10 WARRANTY

- A. Special Equipment Warranty: Refer to Specification 01100 "Special Conditions", Item 14.A, for Special Equipment Warranty requirements.

PART 2 PRODUCTS

2.01 ODOR CONTROL FANS

- A. General: Refer to schedule at end of this specification for specific fan requirements. Provide each odor control fan complete with motor, drive, guard, and baseplate. The fan shall be constructed such that all surfaces in contact with the corrosive gas stream are to be made of solid, corrosion resistant fiberglass reinforced plastic (FRP) for the fan housing and FRP for the fan wheel. All nuts, bolts and fasteners in contact with the gas stream shall be type 316 SST and encapsulated in FRP. AMCA Arrangement 4, which places the motor shaft in the corrosive gas stream, is unacceptable.
- B. Type: Single width, single inlet, backward curved type impeller, minimum Class II centrifugal fan with fixed discharge. Each fan shall be tested and rated in accordance with ASHRAE 51-75, AMCA Standard 210 and shall be licensed to bear the AMCA 211-94 Certified Ratings Seal for air performance, and be guaranteed by MANUFACTURER to deliver rated performance.
- C. Performance: Fan ratings shall be based on tests made in accordance with AMCA Standard 210 and licensed to bear the AMCA Certified Ratings Seal for Air Performance. Fans not licensed to bear the AMCA Seal for performance shall be tested, at MANUFACTURER'S expense, in an AMCA Registered Laboratory. Fans shall have a sharply rising pressure characteristic extending throughout the operating range to assure quiet and stable operation. Fan brake horsepower shall be equal to or less than the BHP specified in the schedule at the listed static pressure and CFM.
- D. Sound: MANUFACTURER shall provide a sound power level rating for fans tested and rated in accordance with AMCA Standards 300 and 301. Sound power ratings shall be in decibels (reference 10-12 watts) in eight octave bands. The maximum sound level shall be at or below 80 decibels at 5 feet.
- E. Construction: Fan shall be constructed in accordance with the ASTM D-4167 standard specification for fiber-reinforced plastic fans and blowers to ensure structural integrity. All parts exposed to the gas stream shall be constructed of, or encapsulated in, an FRP laminate capable of resisting continuous airstream temperatures of 250°F. Fan housing must be fabricated of polyester resins; and "C" grade or better surface veil; To prevent premature deterioration of airstream components a Hartkoate abrasive/erosive resistant coating of 50-60 mils thickness shall be applied or an equivalent coating.
 - 1. Housing: Fan housing shall be designed so that air leakage through joints and seals is negated. All bolted pieces shall be EPDM gasketed for air tightness. Fan housing shall be made of FRP construction and electrically grounded.
 - 2. Fan Wheel: Fiberglass construction, backward curved wheel, non-loading, high efficient, one-piece, resin transfer mold. A hand lay-up or assembly of component type wheel is not acceptable. Utilize Dow Derakane 510-A vinyl ester resin.

3. Fan Shaft: Shaft shall be of Type 316 stainless steel or fiberglass designed to operate 25% below first critical speed. Shaft and impeller shall be electromechanically, statically and dynamically balanced to the requirements of Fan Application Category BV-3, AMCA 204 and shall receive an operational test prior to shipment. Provide Teflon or equivalent double lip seal with Type 316 stainless steel mounting plate between shaft and housing. Seal shall positively prevent liquid and gas leakage.
4. Fan Bearing Base: Provide Type 316 stainless steel fan bearing base.
5. Fan Bearings:
 - a. Each fan shaft shall be supported by approved, grease lubricated, self-aligning ball or roller bearings made of vacuum degassed 52100 steel. Ball or roller bearings shall be made by MANUFACTURERS who are members of the Anti-Friction Bearing MANUFACTURERS Association (AFBMA) and shall be selected for a minimum rating life (L-10) of 100,000 hours at the fans maximum rated speed and based on Basic Dynamic Load Ratings calculated from AFBMA formulas (AFBMA Standards, Section No. 9, and Section No. 11, Latest Revisions). Material factors used in formula calculations shall be based on values assuming a conventional good quality, hardened bearing steel without benefit of vacuum degassing. Specifically, for pound and inch units, factor "f" shall be as given in the tables of AFBMA Standards cited above.
 - b. The operating internal temperature of ball bearings with ambient temperature of 80°F shall not exceed 200°F. Temperature measurements shall be made with a thermal imaging thermometer. (Thermometers shall have an accuracy at 130°F of $\pm 2^\circ\text{F}$). Where thermometer wells are not provided or required, the surface temperature of the bearing housing shall be measured by a thermometer pressed firmly against the surface and sealed with a suitable plastic putty. Temperature readings during inspection and start-up after 3 hours of run time that exceed 140°F as measured by the thermometer-surface method, shall be deemed presumptive evidence that the operating internal temperature of the bearings exceed 200°F, unless SUPPLIER can conclusively prove otherwise with a bearing temperature analysis to the satisfaction of the OWNER or OWNER'S representative. In the absence of such proof, it shall be incumbent to reduce the temperature at or below 140°F with no additional cost to the OWNER.
 - c. Bearing temperature shall not exceed 225°F at the fan's maximum rated speed.
 - d. Computations on bearing selection shall be submitted for approval and shall show complete details of loading. A dynamic factor of 2.0 shall be applied to loading. Ball and roller bearings shall be enclosed in oil-tight housings equipped with approved shaft seal rings and shall be suitably arranged for high pressure grease lubrication.
 - e. The bearing supports for the shaft shall be of rigid design and shall be securely fastened to the base to ensure the proper alignment of the main shaft bearings. Bearings located in the corrosive gas stream are not acceptable.
 - f. Bearings shall be factory lubricated with a premium quality NLGI 2 or 3-grade multi-purpose ball bearing grease having corrosion inhibitors, anti-oxidant additives and mechanical stability for high speed operation. Bearing grease shall be multi-purpose lithium soap grease. The grease shall also have a minimum base oil viscosity of 500 SUS at 100°F and shall be suitable to operate continuously at 225°F. Heavy, long fibered greases will not be acceptable for use in bearings.
 - g. Product and Manufacturer: Provide bearings as manufactured by one of the following:

- 1) Link Belt, Series 6800 roller bearings
6. Fan impeller and driving pulley shall be secured to shaft with keys and set screws.
7. Fan housing shall have flanged discharge and inlet drilled connection and companion flanges (ANSI dimensions). Fan shall be separated from ductwork at inlet and outlet by flanged flexible connections. CONTRACTOR shall coordinate flange drilling with duct.
8. Stainless steel nameplates giving the name of the MANUFACTURER, serial number, model number, rated capacity in cfm, head in inches of water (gage), fan in rpm, and any other pertinent data shall be permanently affixed to each fan with stainless steel hardware.
9. Fan Motors:
 - a. Motors shall conform to the requirements of Section 16010.
 - b. Solid shaft, ball bearing, energy efficient type.
 - c. Motors shall be in accordance with all current applicable standards of NEMA, IEEE, AFBMA, NEC, ANSI and NFPA 820.
 - d. Motors shall be normal starting torque, normal slip, squirrel cage induction type.
 - e. Motors shall be supplied with Class H insulation and rated for continuous duty at 50°C ambient temperature and 80°C (Class B) temperature rise at a 1.15 service factor.
 - f. Motors shall be inverter rated for use with Variable Speed Drives specified in Section 16269.
 - g. Motors shall be of sufficient size so that there shall be no overload on the motors above rated nameplate horsepower under any condition of operation from shut-off to zero head, unless otherwise specifically permitted in this Section.
 - h. Motor thrust bearings shall be adequate to carry continuous thrust loads under all conditions of fan operation.
 - i. Lubrication may be grease or oil type.
 - j. Motor efficiencies shall be determined in accordance with NEMA Standard MG1-12.53a and IEEE Standard 112, Test Method B. Nominal and guaranteed efficiencies shall be included on motor nameplates in compliance with NEMA Standard MG1-12.53.b.
 - k. Stainless steel nameplates giving the name of the MANUFACTURER, serial number and all data shall be permanently attached to each motor.
- F. Access Doors: Raised type, stud mounted access doors with gaskets. Studs shall be embedded and encapsulated in FRP housing.
- G. Odor control fan mounting shall be AMCA standard Arrangement 10 up to 15 horsepower, 20 horsepower and above shall be Arrangement 1 with fabricated Type 316 Stainless Steel Channel Sub-base and slide rail type motor mounting. Fan base shall be bolted directly to equipment slab and shop painted with an epoxy coating for outside/corrosive application.
- H. Drains: The blower shall be properly sealed to prevent condensate leaks and shall be provided with a condensate drain. Provide drains at low point of scroll, 1-inch pipe coupling welded to housing with threaded corrosion resistant plug. CONTRACTOR shall install a trap in the drain of necessary length to prevent foul air from blowing into the drain system.
- I. Drive: Matched V-belts and adjustable sheave pulleys shall be cast steel or cast iron, sized for 1.5 service factor.
- J. Belt and Shaft Guard: Stainless steel construction epoxy painted with tachometer hole, OSHA

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- approved. Provide shaft and bearing guard.
- K. The field installed and operating fan inboard and outboard bearing motions shall not exceed the in-situ operation levels for Fan Application Category BV-3 of ANSI/AMCA 204-96. The instrument system used must have a flat response down to 120 rpm. MANUFACTURER shall measure the vibrations after start-up in the presence of the OWNER'S representative.
- L. Fan vibrations that exceed the ANSI/AMCA 204-96 in-situ operation levels, as described above, during operation in the warranty period shall be reduced by MANUFACTURER. MANUFACTURER can choose to dynamically balance the fan in place using a recognized specialist, replace bearings or make structural modifications to reduce the vibrations, as approved by the OWNER.
- M. MANUFACTURER shall furnish and install a sticker identifying the fan maximum operating speed. Speed changes that exceed this value are not permitted.
- N. Inlet Vane Damper
1. Furnish and install a Type 316 stainless steel manually operated multiple blade inlet vane damper on the suction side of each odor control exhaust fan.
 2. Rated for air velocities up to 6,000 fpm.
 3. Materials of Construction:
 - a. Frame: Type 316 stainless steel min. 10 ga. channel.
 - b. Blades: Type 316 stainless steel min. 10 ga.
 - c. Bearings: Relubricable ball, mounted externally with stainless steel sleeve bearings and stainless steel thrust washers at hub and frame.
 - d. Axles: Type 316 stainless steel full length rod.
 - e. Linkage: Type 316 stainless steel. Swivels and bearings are epoxy coated steel.
 - f. Hub: 316 stainless steel flat panel.
 - g. Operating Lever: Lever arm with locking manual quadrant type 316 stainless steel construction.
 4. Ends: Flanged with bolt holes drilled to match fan inlet.
 5. Manually operated with quadrant locking mechanism.
 6. Provide Type 316 stainless steel nuts, bolts and washers for flanged connections to fan and fan inlet box or flexible connector flange as required.
 7. Mill Finish – No painting.
 8. Product and Manufacturer: Provide one of the following:
 - a. Swartout, Model 851FG.
 - b. Ruskin, Model HD-IVD.
 - c. Or approved equivalent.
- O. Coatings:
1. Baked epoxy phenolic or "cold set" epoxy-phenolic amine cured, brush or spray coats in accordance with manufacturer's specifications.
- P. Acceptable Odor Control Fan Manufacturers:
1. Hartzell.
 2. New York Blower.

3. Or Approved Equal

- Q. Operation and Controls: The operation and controls shall be provided as required to furnish the complete OCS specified in Section 11264.
- R. Provide a parallel blade outlet damper
- S. All fasteners (nuts, bolts and washers) used for Odor Control Fans shall be Type 316 stainless steel.
- T. Odor Control Fans shall be located in outdoor and corrosive areas. All mechanical and electrical equipment and material shall conform to NEMA 4X, non-metallic requirements. Provide panels with a three-point latch door system. Mounting hardware shall be Type 316 stainless steel including fasteners and unistrut.

2.02 SURFACE PREPARATION AND PAINTING

- A. All gears, bearing surfaces, machined surfaces and other surfaces which are to remain unpainted shall receive a heavy application of grease or other rust/corrosion resistant coating. The coating shall be maintained during storage and until the equipment is placed into operation.
- B. MANUFACTURER shall certify, in writing, that the shop primer and shop finish coating system is compatible with intended outside / corrosive application as shown on the Contract Drawings. A corrosive atmosphere of hydrogen sulfide and dilute sulfuric acid are expected to be present.

2.03 TOOLS AND SPARE PARTS

- A. General: MANUFACTURER shall furnish all special tools that are required to assemble, disassemble, repair, and maintain any item of mechanical equipment, with respective equipment. Special tools shall include any type of tool that has been specifically made for use on an item of equipment for assembly, disassembly, repair, and maintenance. When special tools are provided they shall be marked or tagged, and a list of such tools shall be included with maintenance and operation instructions describing use of each marked tool. Additional requirements shall be included with individual items of equipment.
- B. Furnish and deliver the following spare parts for each blower size.
 - 1. Two (2) sets of spare belts.
 - 2. Two (2) sets of bearings.
 - 3. Two (2) replacement Teflon seals.
- C. Furnish list of solvents for cleaning dirt, grease and oil from surface of non-metallic parts.
- D. Spare parts shall be packed in sturdy containers with clear indelible identification markings, referencing the equipment that they are intended for, and shall be stored in a dry, warm location until transferred to the OWNER at the conclusion of the project. Provide complete ordering information including manufacturer, part number, part name and equipment for each part to be used.

PART 3 EXECUTION

3.01 INSTALLATION

- A. SUPPLIER shall install and test all odor control fan equipment. MANUFACTURER's installation report shall be required prior to final acceptance.
- B. Odor control fan equipment shall be installed as specified herein and as shown on Drawings, and in accordance with the manufacturer's recommendations and instructions. Equipment shall be installed in such manner that connecting piping shall not impose any strain whatever on any equipment. Equipment shall be set upon grouted foundations, level or perpendicular, as the case

may be, so that connecting flanges, screwed connections, or flexible connections shall meet without strain or distortion. Base leveling nuts shall be blocked out during grouting of foundations, the grout allowed to set for not less than three days, leveling nuts loosened and followed by grouting of block-outs, with non-shrink grout.

- C. All equipment shall be installed with Type 316 stainless fasteners.
- D. SUPPLIER shall assure that all equipment furnished under this Section is suitable for installation as specified. The SUPPLIER is responsible for determining the necessary clearances and headroom required to move all equipment to its final location.
- E. In every case where a drive motor is connected to a driven piece of equipment by a flexible coupling, the coupling halves shall be disconnected and alignment between motor and equipment checked and corrected. Machinery shall first be perfectly aligned and leveled by means of Type 316 stainless steel wedges and shims near anchor bolts. Anchor bolts shall be tightened against shims on wedges and equipment shall again be checked for level and alignment before placing grout.
- F. Equipment bases shall not be grouted nor foundation bolts finally tightened until all piping connections are complete and in satisfactory alignment with no strain transmitted to the equipment.
- G. Examine pads or supports to receive odor control fans for:
 - 1. Proper anchor bolt locations.
 - 2. Unevenness, irregularities and incorrect dimensions.
- H. Supervise installation in accordance with odor control fan manufacturer's instructions and recommendations.
- I. Provide flanged flexible connections at air inlet and discharge of odor control fans.
- J. All equipment shall be installed on concrete bases and secured with anchor bolts in accordance with the manufacturer's recommendations. CONTRACTOR shall accurately shim base to grade and spaces between shims filled with an approved non-shrink grout. After grout has reached its initial set, exposed edges shall be cut back 1/2-inch and edges neatly finished with 1:2 cement mortar.
- K. Supplier shall include furnishing and applying an initial supply of grease and oil, recommended by the respective MANUFACTURER.
- L. Connect all piping, valves, and accessories as necessary to complete the installation.
- M. Install all conduit and wiring and complete all connections.

3.02 INSPECTION OF ODOR CONTROL FANS

- A. OWNER or OWNER'S representative reserves right to reject any and all items of equipment found to have following: blisters, chips, crazing, exposed glass, dry cracks, burned areas, dry spots, foreign matter, or entrapped air at the laminate surfaces which does not satisfy the tolerances specified in ASTM D 2563 Table 1, Acceptance Level II for inside and outside surfaces or meet the specified requirements.

3.03 INSPECTION AND START-UP ADJUSTMENTS

- A. The SUPPLIER shall perform the following inspection of equipment with the equipment manufacturer's representative.
 - 1. Verify proper equipment mounting and setting.
 - 2. Verify that control, interlock and power wiring is complete.
 - 3. Verify alignment of each motor and drive.

4. Verify proper piping connections and accessories.
 5. Verify that lubrication is completed.
 6. Verify direction of rotation.
 7. Verify setting of safety controls.
 8. Monitor heat buildup in bearings.
 9. Check motor loads against nameplate data.
 10. Verify proper starter overload heater sizes.
 11. Verify function of safety and operating controls.
 12. Verify proper operation of equipment.
 13. Remove all loose materials and obstructions from interior of ducts and fans.
 14. Remove debris and waste materials resulting from installation.
- B. The SUPPLIER shall conduct the following Start-up Adjustments:
1. Adjust fan for proper alignment and flow.
 2. Set volume control devices for approximate positions in preparation for final testing and balancing.
 3. Balance system in accordance with the CFM provided in this section and in Section 11264 Biological Tower-type Odor Control System.

3.04 FIELD TESTS

- A. After OCS SUPPLIER and OWNER or OWNER'S representative have mutually agreed that the equipment installation is complete and ready for continuous operation, MANUFACTURER shall conduct an operating test of the equipment and controls in the presence of OWNER or OWNER'S representative to demonstrate that the equipment and its controls shall function correctly.
- B. MANUFACTURER shall perform standard AMCA tests 210 and 300, as a minimum.

3.05 MANUFACTURER'S SERVICES

- A. MANUFACTURER shall furnish the services of a qualified factory-trained manufacturer's service person for areas where the odor control fans are installed to assist in the installation of the equipment, check the installation before it is placed into operation, assist in the performance of field vibration tests, supervise initial operations, and instruct the plant operators in the care, operation and maintenance of the equipment.
- B. Manufacturer's Representative: Present at Project site or classroom designated by OWNER, for minimum person-days listed in the following table, travel time excluded:

Work Description	No. Person Days	No. Trips
Installation assistance and inspection	1/2	1
Functional and performance testing	1/2	Can be combined with training
Pre-startup classroom or site training	1/2	1
Facility startup and field vibration testing	1/2	Can be combined with training
Follow up visit 12 months after substantial completion for inspection and training	1	1

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- C. Service person shall verify that lubrication systems are complete, clean and filled with the proper grade of lubricants.
- D. Reports: SUPPLIER shall submit a report by service person of each visit to the site. Reports shall provide complete information on time, schedule, tasks performed, persons contacted, problems corrected, test results, training, instruction and all other pertinent information.
- E. Training: In addition to above requirements, furnish services to instruct and train plant operators in the proper care, operation and maintenance of equipment.
- F. Additional Inspections - Twelve (12) months after acceptance of the odor control fans, the manufacturer's factory trained service person shall perform an inspection of the system and submit an inspection report to OWNER.

3.06 FAN SCHEDULE

Number Provided	2
Fan Designation	FAN-101, FAN-102
Elevation, MSL	50 ft
Service	Wastewater Collection System Foul Air
Ambient Temperature Range	0°F - 110°F
Capacity	
Design Flow Rate	25,000 cfm
Static Pressure*	12 inches w.c.
Maximum Speed	1,500 rpm
Maximum Outlet Velocity	2,700 fpm
Motor	
Horsepower	75 HP
Voltage/Phase/Hz	460/3/60
Type	TEFC, Severe Duty
Wheel Diameter	49 inches
Arrangement	Note 1
Rotation	Clockwise
Discharge	Top Horizontal

Note 1: Per Drawings, as determined by system supplier. FAN-101 and FAN-102 are of "Opposite" Arrangements.

*Static pressure includes 4.0" w.c. for the for the bio-scrubber and 8.0" w.c. for all other system losses, including ductwork. Head losses within the bio-scrubber shall be confirmed by the SUPPLIER and the total static pressure of the fans adjusted as necessary to overcome 8.0" w.c. of system losses. The minimum acceptable static pressure rating of the fans shall be 10.0" w.c.

END OF SECTION

Section 13130

PRE-FABRICATED FIBERGLASS ENCLOSURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
1. Pre-fabricated fiberglass enclosures.
 2. Enclosure electrical items, lights, outlets, power panels, alarm systems, and related devices.
 3. Heating, ventilation, and air conditioning.

1.03 DESIGN REQUIREMENTS AND CRITERIA

- A. Fabrication Requirement: Provide factory-built pre-fabricated molded fiberglass enclosure(s) completely assembled in accordance with Drawings and Specifications, delivered to the Project site for installation by the CONTRACTOR. Manufacturer shall provide all lifting cables and hardware required for the off-loading and installation of the building.
- B. Design Criteria:
1. Structural:
 - a. Provide a corrosion-resistant, molded fiberglass bonded structure with no external seams or joints comprised of walls, roof, and door designed for the site conditions and adequate to support equipment and associated loads to be imposed. The walls and roof shall be integral with a three-inch wide flange around the entire lower perimeter for anchoring to concrete slab.
 - b. Walls, roof, and floor shall be sandwich construction consisting of 1/8th inch thick fiberglass skin and 1 inch thick rigid polyisocyanurate foam core. The door shall be of similar construction and 1-3/4 inch thick.
 2. Enclosure:
 - a. Type and Size:
 - 1) Pre-fabricated fiberglass enclosure.
 - 2) Width: 6 feet
 - 3) Length: 4.5 feet
 - 4) Height, at Wall: 7 feet.
 - 5) Roof, Walls, and Floor:
 1. Roof Thickness, Minimum: 1-1/8 inches.
 2. Wall Thickness, Minimum: 1-1/8 inches.
 3. Floor Thickness, Minimum: 1-1/8 inches with minimum foam density of 6 lb/cf.
 4. Anchor Flange Thickness, Minimum: 1/2 inch reinforced for required wind and flood loads.
 - b. Specifications:
 - 1) Flood Load: 250 PSF
 - 2) Snow Load: 30 PSF
 - 3) Wind Load: 125 MPH, Exp "C"
 - 4) Seismic Zone: Zone 4, Seismic Design Category C
 - c. Comply with NEMA 3R requirements.

PRE-FABRICATED FIBERGLASS ENCLOSURES

1.04 SUBMITTALS

- A. Product Data: Provide construction details, material descriptions, dimensions of individual components and profiles, rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Provide plans, elevations, sections, details, and attachments to other work.
 - 1. Detail building components; indicating dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Specific design parameters for this project as specified herein.
 - 3. Layout, sizes, types and materials for anchor bolts to be furnished.
 - 4. Wiring Diagrams: For power, signal, and control wiring diagrams, including terminals and numbers.
 - 5. Building weights and lifting points.
- C. Operation and Maintenance Data: Provide in accordance with Division 1.
- D. Information Submittals:
 - 1. Manufacturer's Certification of Compliance.
 - 2. Special shipping, storage and protection, and handling instructions.
 - 3. Manufacturer's instructions for installation.
 - 4. Qualification Data: For manufacturer and manufacturer's representative, if applicable.
 - 5. Factory tests.
 - 6. Warranties and service agreements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Pre-fabricated fiberglass enclosure shall be the product of a manufacturer having at least ten (10) U.S. installations of the enclosure type being proposed, each with a minimum of 5 years of satisfactory service.
 - 2. A list of similar installations shall be furnished with the shop drawing submittal, including names and telephone numbers of contacts.
- B. Source Limitations: Pre-fabricated fiberglass enclosure of each type specified in this section shall be supplied by a single manufacturer. This does not require that all equipment be manufactured by a single manufacturer, but does require that the manufacturer of the system shall be responsible for the complete system.
- 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.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle and store equipment components in accordance with shop drawings, manufacturer's written instructions, and the requirements of Division 1 Section 01610 "Basic Product Requirements."
- B. Additional Requirements:
 - 1. Store building on dunnage placed at proper locations to prevent cracking, distortion, or any other physical damage.
 - 2. Building provided with lifting fixtures for lifting and setting without incurring damage to walls or roof.

1.07 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail(s) in materials or workmanship within specified warranty period.
 - 1. Warranty Period:

- a. Pre-fabricated Fiberglass Enclosure: Five (5) years from date of Substantial Completion.
 - b. All Other Components: Two (2) years from date of Substantial Completion.
2. Cost for the removal, shipment, repair and installation by CONTRACTOR shall be included in warranty, as well as correction of defective work.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Associated Fiberglass Enterprises.
 2. Bebcos Industries
 3. Plasti-Fab®
 4. Shelter Works™

2.02 ENCLOSURE STRUCTURE

- A. Material Properties:
 1. Fiberglass laminate shall consist of polyester resin reinforced with a minimum of 25% by weight E-Glass and shall meet the minimum physical properties listed in Table 1.

Table 1 Laminate Properties		
Property	ASTM Standard	Value
Tensile Strength, psi	D-698	14,000 psi
Flexural Strength, psi	D-790	25,000 psi
Flexural Modulus, psi	D-790	1,000,000 psi
Thermal Barrier Temperature Rise	E-119	Avg. Temp. Rise of 250 ⁰ F after 15 Minute Exposure

2. Rigid foam core shall be closed cell, dimensionally stable over the specified range of operating temperatures, contain no CFC's, and meet the physical properties listed in Table 2.

Table 2 Foam Properties	
Property	Value
Density, lbs/ft ³	2.0
Closed Cell Content	90%
Thermal Conductivity, BTU in/hr ft ² 0F	0.14
Temperature Range, ⁰ F	-100 to +225
Flame Spread	< 25
Smoke-Developed Index per ASTM E84	< 400

- B. Wall Panels:
 1. Seamless, one-piece wall composed of 1-inch minimum insulating foam core encapsulated between two 1/8-inch fiberglass reinforced polyester skins.
 2. Insulation Value: R-6.7.

PRE-FABRICATED FIBERGLASS ENCLOSURES

3. Exterior and interior surfaces shall a 10 to 20 mil gelcoat finish backed by a resin rich layer of resin and chopped glass, containing a UV inhibitor. Gelcoat shall be white in color.
 4. When equipment is to be secured to the walls, provide a layer of 1/2-inch wood sheeting bonded to the foam and encapsulated into the wall.
 5. Wall penetrations are to be reinforced, integrally molded as applicable, designed for the loads involved.
 6. Provide an integrally molded three inch minimum flange for mounting the enclosure to a concrete foundation.
- C. Roof:
1. Vaulted hip or gabled design, seamless, one-piece roof composed of 1-inch minimum insulating foam core encapsulated between two 1/8-inch fiberglass reinforced polyester skins.
 2. Insulation Value: R-6.7.
 3. Provide roof trusses, molded and integrated into roof panels, as required for support and to suspend loads from roof.
 4. Exterior and interior surfaces shall a 10 to 20 mil gelcoat finish backed by a resin rich layer of resin and chopped glass, containing a UV inhibitor. Gelcoat shall be white in color.
 5. Stainless Steel removal lifting eye.
- D. Floor: Not Included.
- E. Doors:
1. Construction: Insulated FRP door of similar construction to walls, mounted in a recess, having a minimum clear opening of 36" by 72", and a raised all weather sill.
 2. Seal or Gasket: Provide a resilient, closed cell form neoprene seal per ASTM D1056 on all four edges.
 3. Hardware:
 - a. Provide stainless steel hardware consisting of a 3-point door catch holding door closed at top, middle and bottom.
 - b. Provide padlocking door handle, heavy duty hinges, and a spring loaded door holder.
 - c. Hinges shall be of a tamper proof design.
 - d. Provide drop type door handle having large offset handle and escutcheon for a padlock and an inside door handle.
 - e. On double doors, one door receives hardware described above and the other is held closed with a slide bolt.
 4. Provide a rain visor or small awning over the door.
 5. Door Styles:
 - a. Nominal Width: Single Door 3'-4"
 - b. Nominal Height: 6'-8"
- F. Finishes:
1. Exterior: Finished with a smooth gelcoat surface of minimum 10 mil thickness with color as indicated below.
 - a. Walls: White
 - b. Roof: White
 - c. Door: White
 2. Interior: Finished with a smooth white gelcoat surface of minimum 10 mil thickness
- 2.03 ELECTRICAL AND HVAC
- A. For the enclosure (6'-0" wide, 4'-6" long, 7'-0" wall height) provide 100A power service, two convenience outlets, two fluorescent light fixtures, and heater and exhaust fan as specified under paragraphs I and J.

- B. Electrical Requirements: Provide the following main power distribution, lighting, convenience outlets, and related electrical devices.
1. Power Service: 100A; 120/240 V, single phase, 60 Hertz.
 2. Disconnect Switch: 100A exterior disconnect switch.
 3. Main Distribution Panel: 100A single phase, 30 spaces.
 4. Surge Suppression: 40K peak amp surge suppressor.
 5. Convenience Outlets: 2 125V/20A Duplex outlets.
 6. Exterior GFI Outlets: (1) 125V/20A Outlet.
 7. Timer Switch: (1) Six hour.
- C. Lighting: Unless otherwise shown on the Drawings provide the following interior and exterior lighting.
1. Interior: 2 each 4-foot, dual tube fluorescent light fixtures with light guards.
 2. Exterior: (1) Exterior light with photocell and motion detector above each door.
 3. Emergency: (2) Emergency fixture with dual flood lights located adjacent to each door.
 4. Switch (2) 20 amp light switch located adjacent to each door.
- D. Alarms: Provide a 25-pair alarm terminal box with intrusion, smoke, power failure, HVAC failure, and high/low temperature.
- E. Grounding: (1) 2-inch x 15-inches x 3/4-inch ground bar.
- F. Conduits, Boxes, and Related Items: PVC construction.
- G. Addition Items:
1. Smoke Detector: (1) Smoke detector.
 2. Fire Extinguisher: (1) 5-lb CO2 fire extinguisher, wall mounted by each door.
 3. Log Book: (1) Literature Holder, wall mounted.
- H. Paragraph "F" will be used when enclosure is used for MCC and paragraphs "I" and "J" will be used for chlorine equipment or where air conditioning is not required.
- I. Heating:
1. Provide a forced air electric space heater for freeze protection. Heater shall be thermostatically controlled, and shall be capable of maintaining 60°F with an outdoor ambient temperature of 0°F.
 2. Heat load calculations shall be included in enclosure submittal.
 3. Thermostat shall be adjustable from 60 to 80°F.
- J. Ventilation:
1. Exhaust Fan:
 - a. Capacity: Unless otherwise specified, provide 12 air changes per hour exhaust fan with an exterior gravity louver.
 - b. Location: On the side wall, near the door.
 - c. Control: Manual and automatic operating modes using an exterior wall mounted, NEMA 4, 3-position selector switch located at the entrance door.
 - 1) Identification: "Exhaust Fan".
 - 2) Positions labeled AUTO/OFF/ON.
 1. "AUTO" position; fan shall be energized when the enclosure door is opened.
 2. "ON" position, the fan shall run continuously.
 3. "OFF" position will de-energize the fan.
 - 3) Exhaust fan shall not share a breaker circuit with wall receptacles.
 2. Vents: Provide adjustable, louver vents, complete with screen and covered with FRP shroud at locations shown on the Drawings.

2.04 SOURCE QUALITY CONTROL

- A. Fiberglass Enclosure: Factory inspected prefabricated fiberglass enclosure as follows:

PRE-FABRICATED FIBERGLASS ENCLOSURES

1. Visual inspection for defects shall be made without the aid of magnification.
2. Defects shall be classified as to type and level as shown in ASTM D2563.

Table 3	
Fiberglass Enclosure Allowable tolerances	
Defects	Allowable Tolerances
Cracks, crazing, chips, pits, blisters, dry spots, fish eyes, burned areas, or entrapped air	None
Scratches	None more than 0.002 inches in depth
Exposed glass, exposure of cut edges	None
Wrinkles and solid blisters	Maximum deviation: 10% of thickness, but not to exceed 1/8 inch
Surface porosity (pinholes or pores in the laminate surface)	None
Foreign matter	None

3. Allowable surface tolerances shall not exceed tolerances listed in Table 3.

B. Electrical Testing:

1. Inspect and test electrical systems prior to shipment. Inspection and testing results shall be documented, signed by the inspector, and a copy of the inspection checklist provided.
2. Electrical components and parts will be inspected for quality workmanship and installation. Inspection includes conduit, conduit couplings, conduit brackets, electrical panels, A/C units, exterior and interior lights, outlets, smoke detectors, and alarms. In addition, the following tests will be performed as a minimum:
 - a. Polarity test.
 - b. Continuity test.
 - c. Dielectric test.
 - d. Operational test.

- C. Product Inspection:** Provide Manufacturer's Certification of Compliance indicating the product has been manufactured in compliance with the Drawings and Specifications. If repairs are required, they will be performed and reinspected before the product is approved for shipment.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Install and adjust equipment in accordance with the Drawings, approved shop drawings, and the manufacturer's instructions. Do not operate the equipment until the installation is approved by the manufacturer's representative.
- B. Enclosure should be handled in such a manner at the jobsite such that they are not damaged from equipment and excessive stresses. Lift gear, rigging, etc. shall be as specified by the manufacturer.
- C. Examine and inspect enclosure upon arrival for compliance with Drawings and Specifications. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Lift enclosure per manufacturer's instruction and place on concrete slab. Install enclosure on the concrete foundation in accordance with manufacturer's instruction.
- B. Prefabricated fiberglass enclosure shall bear fully on a concrete foundation that is larger than the enclosure footprint. Concrete foundation should be level to 1/8-inch in all directions. Provide positive drainage from the foundation.

END OF SECTION

SECTION 13440

ODOR AND BIO-TRICKLING FILTER CONTROL SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Programmable logic controllers (PLCs), Human Machine Interface (HMI), remote input/output (I/O) units, communication equipment, pump controller, programmer, control switches, relays, and indicators.

1.02 REFERENCES

- A. National Electrical Manufacturers Association (NEMA).
 - 1. NEMA ICS 1 - General Standards for Industrial Control and Systems.
 - 2. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.
 - 3. NEMA ICS 3 - Industrial Systems.
 - 4. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
 - 5. NEMA ST 1 - Standard for Specialty Transformers (Except General Purpose Type).
- B. Instrument Society of America (ISA).
- C. Underwriters Laboratories, Inc. (UL).
- D. Factory Mutual (FM).
- E. Institute of Electrical and Electronic Engineers (IEEE).
- F. National Fire Protection Association (NFPA). ANSI/NFPA 70 - National Electrical Code (NEC).
- G. Joint Industrial Council (JIC).
- H. American National Standards Institute (ANSI).

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1.03 SUBMITTALS

- A. Submit product data, shop drawings and samples (if samples are requested by the City Engineer) under provisions of Section 01330 - Submittal Procedures.
 - 1. Submit in complete packages grouped to permit review of related items as outlined in these specifications.
 - 2. Bind submittals in three-ring binders with complete indexing and tab dividers. Completely tag and label equipment information to correspond with Drawings.
 - 3. Review of Submittals will be for conformance to Contract Documents and for application to specified functions.
- B. Product Data: Submit descriptive product literature including manufacturer's specifications for each component specified.
- C. Shop Drawings: Indicate layout and mounting of completed assemblies and systems, interconnecting piping and cabling, dimensions, weights, external power and communication connections and programming information.
 - 1. Panel, Console and Cabinet Information.
 - a. Layout drawings, including the following:
 - 1) Front, rear, end and plan views to scale.
 - 2) Dimensional information.
 - 3) Tag numbers and functional names of components mounted in and on panels, consoles or cabinets.
 - 4) Product information on panel components.
 - 5) Nameplate locations and legends, including text, letter sizes and colors to be used.
 - 6) Location of anchoring connections and holes.
 - 7) Location of external wiring and

- piping connections.
- 8) Mounting and installation details.
- 9) Proposed layouts and sizes of graphic display panels.
- b. Wiring and piping diagrams, including the following:
 - 1) Name of panel, console or cabinet.
 - 2) Wiring sizes and types.
 - 3) Piping and tubing sizes and types.
 - 4) Terminal strip numbers.
 - 5) Color coding for each wire and color coding legend.
 - 6) Functional name and manufacturer's designation of components to which wiring and piping are connected.
- c. Electrical control schematics in accordance with JIC standards.
- d. Plan showing equipment layout in each area.
- 2. Field Wiring and Piping/Tubing Diagrams
 - a. Wiring and piping/tubing sizes and types.
 - b. Terminal strip, device terminal and wire numbers.
 - c. Color coding.
 - d. Designation of conduits in which wiring is to be located.
 - e. Location, functional name and manufacturer's designation of items to which wiring or piping are connected.
 - f. Point-to-point wiring diagrams identifying every

termination point and connection.

3. Instrumentation Diagrams

a. Prepare instrument loop diagrams for analog and digital displays, and control and I/O loop diagrams, using ISA standard symbols in accordance with ISA Standard S5.4. Drawings shall follow the format in Attachment C and include the following:

- 1) Instrument tag numbers.
- 2) Functional name, manufacturer's name, product name and model or catalog number of each item.
- 3) Location of each item.

b. Submit loop diagrams, wiring diagrams, PLC and control schematics on 4.7 GB DVD, formatted as AutoCAD files using the latest release of AutoCAD current and available on bid date, or any subsequent version. Identify diagrams, schematics and other files with computer-printed labels affixed to each diskette. Leave at least 200,000 bytes free space available on each DVD.

c. In addition, submit such diagrams and schematics laser-printed on 8.5-inch x 11-inch paper. Use lettering and numerals of at least 1/16-inch nominal height.

4. Programmable Controller System I/O Loop Wiring Diagrams

a. Prepare drawings on a module-by-module basis. Include the following information:

- 1) Rack numbers, module types and slot numbers, module terminal point numbers, and location and identification of intermediate panel and field terminal block and strip numbers to which I/O wiring and

power supply wiring is connected. Identify power supply circuit numbers and ratings.

- 2) Wiring sizes, types, wire numbers and color coding.
 - 3) Designation of conduits in which field I/O wiring is to be run.
 - 4) Locations, functional names, tag numbers and manufacturer's names and model numbers of panel and field devices and instruments to which I/O wiring is connected. Label wiring and cables at both ends and within junction and terminal boxes. Use sleeve-type plastic wire markers covered with clear heat-shrink labels, or machine-printed permanent ink heat-shrink labels by Brady or approved equal.
- b. For each drawing, submit one reproducible hardcopy and one copy on 4.7 GB DVD, formatted as AutoCAD files using the latest release of AutoCAD current and available on bid date, or any subsequent version. Identify diagrams, schematics and other files with computer-printed labels affixed to each diskette. Leave at least 200,000 bytes free space available on each DVD.
 - c. In addition, submit such diagrams and schematics laser-printed on 11 x 17 inch paper. Use lettering and numerals of at least 1/16 inch nominal height.
5. System Programming Information
- a. At least six weeks prior to substantial completion, submit detailed programming information consisting of ladder logic and proposed program code, complete input, output, relay, register and controller identification labels, memory allocation table, and written description of program operation.
 - b. Ladder logic diagrams shall contain a written descriptive note for each line of program code describing the function and logic of that line.
 - c. Submit documents in hard copy and as computer-

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- d. readable files 4.7 GB DVD. Leave at least 200,000 bytes free space available on each DVD. PLC, HMI, MOR, VFD, controllers and all other operational, installation and application related programs required necessary by the City of Houston with the installation shall be submitted in native programming language files.

D. Quality Control Submittals

1. Factory Test Reports: If specified, submit six copies.
2. Testing Procedures: Submit testing procedures proposed to verify input, output, loop, and register operations, system logic verification, and spare memory capacity. Testing procedures shall detail, as a minimum, verification of required functions as follows:
 - a. Verification of pump start, pump stop, and well level alarm outputs by simulation of analog signals representing pump level.
 - b. Verification of each discrete input via external manually-operated switch.
 - c. Verification of each analog input by connection of external analog indicator in input loop.
 - d. Verification of each analog output by connection of external analog indicators.
 - e. Verification of communications system by hardwire connection via modem and wiring to a similar unit. Demonstrate operation and status monitoring of each register specified for external monitoring.
 - f. Verification of spare memory capacity by hard copy printout of full memory bit map after successfully demonstrating that system logic, inputs, outputs and communications features are fully installed and operational.
 - g. Test and verify system with external devices required to simulate field connections connected simultaneously for a full system test. Reconnecting external devices to verify portions of

the systems at a time is not acceptable.

3. Certificates: Under provisions of Section 01450 - Contractor's Quality Control, submit manufacturers' certificates that equipment and systems meet or exceed specified requirements.
 4. Instructions: Submit manufacturer's installation instructions for each component specified.
 5. Field Reports: Submit 6 copies of Manufacturer's Installation Inspection, Field Calibration and Field Testing Reports.
 6. Site Acceptance:
- E. Operations and Maintenance (O&M) Data.
1. Submit operation and maintenance data notebook in accordance with Section 01782 - Operations and Maintenance Data.
 2. Information and drawings submitted must reflect the final installed condition. Revise documents requiring updates following testing and start-up.
 3. In addition to the content specified in Section 01782 - Operation and Maintenance Data, provide the following information:
 - a. Name, address and telephone number of the control system supplier's local service representative.
 - b. Complete list of supplied system hardware parts with full model numbers referred to system part designations, including spare parts and test equipment provided.
 - c. Copy of approved submittal information and system shop drawings as specified in Paragraph 1.3, Submittals, with corrections made to reflect actual system as tested, delivered and installed at the site. Provide half-size blackline reproductions of all shop drawings larger than 11 inches x 17 inches.
 - d. Complete up-to-date system software documentation.
 - e. Original copies of manufacturer's hardware, software, installation, assembly and operations manuals for the

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programmable controller and data communication system, single loop and multi-loop controllers and other control system components. In addition to hard copy versions, provide all manuals in PDF format on 4.7 GB DVD.

- f. Instructions for PLC replacement adjustment, and preventive maintenance procedures and materials.
- g. Control system description and system operation sequence instructions.
- h. For each major system/subsystem, in separate binders, submit PLC ladder logic programming documentation, PLC I/O schematics, control and loop diagrams, electrical drawings, system description, operation instructions and files on 650 MB 4.7 GB DVD.

F. Project Record Documents

- 1. Submit record documents under provisions of Section 01785 - Project Record Documents.
- 2. Revise system shop drawings, software documentation and other submittals to reflect system as installed. Accurately record locations of controller cabinets and input and output devices connected to system. Include interconnection wiring and cabling information and terminal block layouts on rite in the rain all weather writing paper model 8511 in a suitable drawing pocket installed inside the controller cabinet door.
- 3. Insert half-size blackline prints of wiring diagrams applicable to each control panel in a clear plastic envelope and store in a suitable print pocket or holder inside each control panel.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer shall be a company specializing in manufacturing products specified in this Section, having proven compatibility with the City's existing facilities and at least three years of documented experience. The company

shall maintain service facilities within 100 miles of the City of Houston.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site in factory-sealed containers. Store and protect products under provisions of Section 01610 - Basic Product Requirements.
- B. Check for damage upon receiving products on site.
- C. Store products in a clean, dry area; maintain temperature in accordance with NEMA ICS 1.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature above 32 degrees F and below 104 degrees F during and after installation of products.
- B. Maintain area free of dirt and dust during and after installation of products.
- C. Provide temporary heating and air conditioning units and equipment required to maintain environmental conditions specified for control and MCC panels.

1.07 MAINTENANCE SERVICE

- A. Provide manufacturer's maintenance services for programmable logic controllers for one year from Date of Substantial Completion without additional cost to the City.

PART 2 P R O D U C T S

2.01 PROGRAMMABLE LOGIC CONTROLLER (PLC)

A. PLC CPU

- 1. Manufacturer and Model: Siemens Industry, S7-1214C
- 2. Port: Ethernet, RJ45
- 3. Built-in Discrete I/O: 14 Discrete Inputs (24 VDC), 10 Relay Outputs
- 4. Built-in Analog I/O: 2 Analog Inputs
- 5. Power: 24 VDC
- 6. Expandability: 8 Signal Modules, 1 Signal Board, 3 Communication Modules

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B. Discrete Input Expansion Module

1. Manufacturer and Model: Siemens Industry, S7-1221
2. Discrete Inputs: 16
3. Input Type: 24VDC, Current Sourcing/Sinking

C. Relay Output Expansion Module

1. Manufacturer and Model: Siemens Industry, S7-1222
2. Relay Outputs: 16
3. Output Type: 5-30 VDC, 30W / 5-250 VAC, 200W

D. Discrete Input / Output Expansion Module

1. Manufacturer and Model: Siemens Industry, S7-1223
2. Discrete Inputs: 8
3. Input Type: 24VDC, Current Sourcing/Sinking
4. Relay Outputs: 8
5. Output Type: 5-30 VDC, 30W / 5-250 VAC, 200W

E. Analog Input Expansion Module

1. Manufacturer and Model: Siemens Industry, S7-1231
2. Analog Inputs: 4
3. Input Types: 0-20 ma

F. Analog Output Expansion Module

1. Manufacturer and Model: Siemens Industry, S7-1232
2. Analog Outputs: 4
3. Output Types: 0-20 ma

G. Memory Card

1. Manufacturer and Model: Siemens Industry, S7-954
2. Capacity: 4 MB or larger.

H. Communication Interfaces

1. Profibus-DP: Integral to CPU, master/slave, capable up to 12 Mbit/sec, configured in standard PLC programming environment. Supports Profibus-DP Master, Profibus-DP Slave, MPI with programmer, HMI and S7 communications.
2. Ethernet Interface: Integral to CPU, 10/100 Mbps with automatic speed detection, supports open TCP/IP, PLC

programming, HMI communications, ST Communications, Profinet CBA and Profinet IO-Controller.

3. Ethernet Switch: Managed Industrial Ethernet Switch to be mounted in control panel and connected to PLCs with Ethernet interface.

- a. Scalance X204-2

- 1) Manufacturer and Model: Siemens X204-2
- 2) Electrical Ports: Four RJ45, 10/100 Mbps, connectors latch to housing for strain relief.
- 3) Optical Ports: Two female ST pairs, 100 Mbps
- 4) Fiber Topology: Bus, Star, and ring
- 5) Power: Redundant 24 VDC
- 6) Mounting: Standard DIN rail, PLC Rail
- 7) Diagnostic LEDs: Power, Link Status, Communications
- 8) Housing: Metal

- I. Ethernet Networking

1. Ethernet Switch - Remote WiMAX

- a. Manufacturer and Model: Siemens Industry, X310
- b. Design: Industrial, Managed, DIN Rail Mount
- c. Copper Ports: Ten (10) RJ45, 10/100 Mbps
- d. Fiber Optic Ports: None
- e. Configuration Back-up: Include configured C-Plug
 - 1) Mounting: Standard DIN rail, PLC Rail
 - 2) Diagnostic LEDs: Power, Link Status, Communications

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- 3) Housing: Metal
- 4) Include C-Plug Configuration Plug
2. Industrial Ethernet Cable, Copper, for Runs Outside Control Panels
 - a. Manufacturer and Model: Siemens Energy & Automation, 6XV1-840-2AH10
 - b. Style: Industrial Ethernet Fast Connect (FC) Standard Cable
 - c. Type: Four-wire, shielded
 - d. Jacketing: Green PVC Sheath, 6.5 +/- 0.4 mm OD
 - e. Temperature: -40 to 70 deg. C operating, transport and storage
 - f. Include Stripping Tool: Siemens Energy & Automation, 6GK1-901-1GA00
3. Industrial Ethernet Connectors, Copper
 - a. Manufacturer and Model: Siemens Energy & Automation 6GK1-901-1BB10-2AA0 (straight) or 6GK1-902-1BB20-2AA0 (90-degree)
 - b. Permissible Cable: Industrial Ethernet FastConnect Cable
 - c. Installation: Insulation Displacement via simple cable insertion and housing closure
 - d. Strain Relief: Via quarter-turn locking mechanism
 - e. Housing: Metal with metal spring clip
4. Industrial Ethernet and Profibus Cable, Fiber Optic
 - a. Manufacturer and Model: Optical Cable Corp or approved equal by wastewater operation.
 - b. Fibers: 6 multimode fibers minimum, 25% spare pairs minimum, 62.5/125 graded index

- c. Type: Tight-Buffered, Riser-Rated, Multi-fiber Breakout-Grade Cable
 - d. Jacketing: Indoor/outdoor PVC outer jacket, Color-coded subcables protected to permit direct field termination without patch boxes, jumpers, splices, etc
 - e. Primary Fiber Buffer: 500 micron acrylate buffer over each optical fiber
 - f. Secondary Fiber Buffer: 900 micron elastomeric tight buffer over each optical fiber
 - g. Connectors: ST, Factory-terminated or field-installed and tested
 - h. Diameter: 9.5 mm (0.37 in)
 - i. Tensile Load Rating: 270 lbs. long-term, 670 lbs. short-term (installation)
 - j. Minimum Bend Radius: 3.7" under long-term tensile load, 7.4" under installation load
 - k. Temperature: -40 to 85 deg. C operating
5. Industrial Ethernet and Profibus Fiber Optic Patch Panel
- a. Manufacturer and Model: AWC PB-12ST-WM (up to 12 fibers) or PB-24ST-WM (up to 24 fibers)
 - b. Design: Metal box with latching door covering two chambers
 - c. Connectors: Populated 6-packs with ST connectors
 - d. Mounting: Wall mount
- J. Profibus Networking
- 1. Profibus Cable, Copper

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- a. Manufacturer and Model: Siemens Energy & Automation, 6XV1-830-0EH1
 - b. Style: Profibus Fast Connect (FC) Standard Cable
 - c. Type: Two-wire, shielded
 - d. Jacketing: Purple PVC Sheath, 8.0 +/- 0.4 mm OD
 - e. Include Stripping Tool: Siemens Energy & Automation, 6GK1-905-6AA00
2. Profibus Connector, Copper
- a. Manufacturer and Model: Siemens Energy & Automation, 6ES7-972-0BA50-0XA0
 - b. Cable Outlet: 90-degree, dual cable path
 - c. Terminating Resistor: Integrator resistor combination, slide switch enabled
 - d. Interfaces: DB9F connector and four insulation displacement terminals
- K. Programming, Software and Programming Equipment
1. Configure system and program for operation as specified in this Section.
 2. System Software: Siemens Step 7 software will be loaned by City for utilization by contractor on this project. Contractor to supply any other software or interfaces and cables needed to support equipment supplied on this project.
 3. Control Program Data Sheet: Contractor shall complete and submit each system Data Sheet to Control Program Librarian designated by City of Houston. System I/O list shall be submitted with Data Sheet to the City of Houston two weeks prior to the 7-day test where communication can be verified by the Control Center.
 4. Programmer: (City of Houston Wastewater Plant applications only): HP ZBook Mobile Workstation or equivalent current model, new, submitted in the original package including manuals having at least the following features as minimum:

- a. Operating system: Genuine Windows 7 Professional 64
- b. Processor: Intel Core i7-4700MQ Processor (2.4 GHz, 4MB L3 cache)
- c. Memory: 8GB 1600 MHz DDR3L SDRAM.
- d. Hard drive: 750 GB 7200 rpm SATA, 32GB MSATA SSD
- e. Optical drive: DVD-ROM; DVD+-RW SuperMulti DL LightScribe; Blue-ray R/RE DVD+/-RW SuperMulti DL
- f. Display: 15.6 diagonal LED-backlight HD anti-glare
- g. Graphics: NVIDIA Quadro FX 1800M graphics with 1 GB dedicated GDDR5 video memory.
- h. I/O Ports: External – 3USB 2.0, 2USB 3.0, 1eSATA, 1 external VGA monitor, 1 Display Port, 1 1394a, 1 stereo microphone in, 1 stereo headphone/line-out, 1 AC power, 1 RJ-11, 1 RJ-45, 1 docking connector, 1 secondary battery connector.
- i. Slots: 1 Express Card/54, 1 Smart Card Reader, 1 Secure Digital.
- j. Network interface: Integrated Intel Gigabit Network Connection (10/100/1000 NIC).
- k. Wireless: HP Mobile Broad (powered by Gobi) with GPS; Intel Centrino Ultimate-N 6300 (3x3) 802.11 a/b/g/n; HP Integrated Module with Bluetooth 2.1 Wireless Technology.
- l. Energy Efficiency: ENERGY STAR
- m. Battery: HP Long Life 8-cell (68 WHr) Li-Ion
- n. Power supply: External 150-watt Smart AC adapter; External 120-Watt Smart AC adapter; External 90-watt Smart AC adapter; HP Fast Charge
- o. Security management: Standard – Integrated Smart Card Reader, HP ProtectTools, TPM Embedded Security Chip 1.2, Enhanced Pre-Book Security, HP Spare Key (require initial user setup), HP Disk Sanitizer, Enhanced Drive Lock, drive Encryption for HP ProtectTools, Credential Manager for HP ProtectTools,

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File Sanitizer for HP Protect Tools

- p. Warranty: HP services offers limited 3-year standard parts and labor onsite, next business day warranty, and toll-free 7 x 24 hardware technical phone support; 1-year limited warranty on primary battery. On-site service and warranty upgrades are also available.
 - q. Preinstalled Microsoft Windows in latest versions currently available that are compatible with HMI software.
 - r. Programming cable and adapter for PLC programming.
 - s. Compaq Workstation carrying case (overall size 18"x13"x5").
- L. Spare Capacity: Provide at least 25 percent spare rack space, and 25 percent spare I/Os configured, wired, terminated, and identified as such, but not used in program.
- M. Provide at least 25% of each PLC module furnished as spare parts. Minimum spare parts will include the following for each type furnished:
- 1. One discrete input, of each type.
 - 2. One discrete output, of each type.
 - 3. One analog input, of each type.
 - 4. One analog output, of each type.
 - 5. One PLC power supply, of each type.
 - 6. One CPU with Profibus-DP and Ethernet ports.
 - 7. One Ethernet Switch.
 - 8. One Operator TP900.
- N. Connect PLC inputs/outputs including analog inputs through snap-on isolated fused terminal blocks.
- O. Separate the AC and control signals from DC and loop signals by at least 6 inches. Provide a barrier between AC and DC within the raceways.

2.02 LOCAL WORK STATION

A. General

1. Manufacturer and Model: Siemens Energy & Automation, TP900 touch panel.
2. Display: 9.0" 800 x 480 TFT LCD Touch Panel.
3. Keyboard: Numeric / Alphabetic Entry.
4. Memory: 12 MB.
5. Memory Card: Two MMC/SD combination slot
6. Operating System: Windows CE
7. Ports: One RS 422/485, USB, Ethernet RG-45
8. Power: 24 VDC.
9. Certifications: IP65 / NEMA 4 / FM Class I, Division 2 when mounted.
10. Configuration: HMI shall be programmed to display the process diagrams shown on the drawing and display status and alarms indicated on the P&ID diagram as required for BTF, and odor control system. Where displays required modification.
The contractor to display required information needed for the operations. The CONTRACTOR shall provide necessary modifications and configurations and enter the required variable parameters to provide a complete functional integrated system for each process unit. The CONTRACTOR shall customize the application software to meet site-specific conditions for each HMI installed or used when existing. The system shall be fully tested to be operational prior to substantial completion.
11. Configuration Software: Configuration software and cable will be loaned by City for utilization by CONTRACTOR on this project. The CONTRACTOR to supply any other software needed to support equipment supplied on this project.

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12. Provide necessary cables, connectors, and interfaces to communicate between Operator Panel and PLC processor. New HMI shall be installed for Odor and New Bio Trickling Filter PLC.
13. Supply configuration software, latest version, and download cable.
14. Note: Pump Information and necessary status points shall be Configured as needed. All configurations shall be performed by the contractor for panels show to be installed on the drawings:
 - a. Odor PLC: Display all screens (see below a sample of display as minimum)
 - 1) PLC Screen List
 - 2) Odor system equipment diagram
 - 3) Odor points indication (equipment on "RED" off "GREEN")
 - 4) Odor Status/Alarms and indication
 - 5) PLC I/O Health Status
 - 6) 7-day level/flow trends/alarm summary
 - b. Bio Trickling Filter (BTF) PLC: Display all existing screens (below see a sample of display as minimum)
 - 1) PLC Screen List
 - 2) BTF system equipment diagram (show H₂S and flow reading, sensors and valves monitored for each tank and equipment status
 - 3) BTF Status/Alarms, and meter readings
 - 4) PLC I/O Health Status
 - 5) 7-day flow, tank level, and analyzers trends/alarm summary
 - c. HMI display shall be provides at the SCADA console for all above displays as well as all points for screens above showing levels, flows,

equipment status and high and low alarms.

2.03 CONTROL SWITCHES AND INDICATOR LIGHTS

A. Manufacturers

1. Automatic Timing and Controls Company.
2. Cutler Hammer.
3. Eagle Signal Company.
4. General Electric Company.
5. Square D Company.
6. Allen Bradley.
7. Siemens

B. Substitutions: Comply with Section 01630 - Product Substitution Procedures.

C. Control Switches

1. Contacts: NEMA ICS 2; at least two Form C contact sets.
2. Contact Ratings: NEMA ICS 2; 120V, 10 ampere inductive.
3. Selector Switch Operators: NEMA ICS 2; heavy-duty, oil-tight, NEMA 4 multi-position rotary selector switch.
4. Push-button Operator: NEMA ICS 2; heavy-duty oil-tight NEMA 4 unguarded and lockable type; black for start, red for stop.

D. Indicator Lights: Red for run, amber or yellow for alarm, green for control mode; LED, oil-tight, 100,000-hour rated life expectancy; rated voltage approximately 125 percent of nominal 120 VAC operating voltage. To be push-to-test type.

2.04 CONTROL RELAYS

- A. Contacts: Three Form C contact sets (3PDT).
- B. Rating: 120 volt, 10 ampere inductive.

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- C. Coil Voltage: 120 volt, 60 Hz AC.
- D. Socket: DIN Rail, Include hold-down clip.
- E. Features: 11-pin tube socket relay base, external color-coded test button, mechanical and electrical status indications, impact-resistant thermoplastic case.
- F. Manufacturer: Turck, Siemens, or equal approved by end user.
- G. Spare Units: In addition to units installed, furnish 2 spare units.

2.05 TIME DELAY RELAYS

- A. Contacts: Three Form C contact sets (3PDT).
- B. Contact Ratings: DPDT Class; 120 volt 10 ampere inductive.
- C. Coil Voltage: 120 volt 60 Hz AC.
- D. Socket: Turck S3B with coding system, label and label holder (11-pin).
- E. Description: Control relay as specified above in Paragraph 2.04, with added Time Cube Module as manufactured by Turck, Inc.; series CT3, with on or off delay, as indicated.
- F. Features: DIP switch-selectable timing ranges of 0.2 to 3 seconds, 0.8 to 12 seconds, 0.1 to 1.5 minutes and 0.8 to 12 minutes; externally-adjustable graduated time dial; solid-state digital timing system.
- G. Spare Units: In addition to units installed, furnish 2 spare units.

PART 3 EXECUTION

3.01 SYSTEM DESCRIPTION

- A. Bio Trickling Filter
 - 1. General: The Bio Trickling Filter is a vendor provided package with its own controller (Siemen S7-1214C). It consists of two reactors, two blowers, water control solenoid valves, controller and instrumentation indicated on the drawings.
 - 2. There shall be remote control capabilities as shown on the P&ID where the operator can adjust the feed rate

and other control associated with this package. The system is monitored and controlled from the SCADA and local HMI. The PLC shall be connected to the Ethernet switch at the Odor control panel via Cat5e/Cat 6.

B. Odor Control

1. General: There is two blower supplying air to the Lift Station Wet Well.
2. Local Manual Control: There shall a three-position HOA switch at the Local Control Station (LCS) for the blower. When this switch is in Hand, operator can start the blower. Operator can also monitor the operational status and alarm conditions of the blower from the SCADA.
3. Remote Manual Control: When the HOA switch is in Auto, the operators can monitor the blower and send a Start/Stop command to the blower from the plant HMI. There will be no automatic sensor to control the blowers automatically.
4. Refer to the P&ID diagram as well as control schematics for all PLC I/O points to be monitored and controlled by SCADA system.

- E. Communications: PLC shall be capable of full two-way communications with the City of Houston Central Control facility. Communications shall have the capability to transmit all control panel PLC status and alarm additional information indicated in the Drawings, and miscellaneous data via City of Houston SCADA software package and protocol. Provide necessary hardware and software required to implement the communications system as part of system integration and testing.

Programming and modifications required at the City of Houston Central Control facility will be performed by contractor. Contractor shall provide iFIX application graphic and programming required and develop displays to monitor and control all existing equipment and systems associated with bio-tricking filter, and odor control blower. Contractor shall demonstrate communication and data exchange at the local SCADA and Groveway Control Center. Contractor shall submit the list of all I/O points with new S7 PLC address. All new and existing I/O points to be verified by contractor for any bit change and message displays for status, analog, and rate databases. The programming of

ODOR AND BIO-TRICKLING FILTER CONTROL SYSTEM WBS No.: R-000020-0010-3

the package units such as Bio Trickling Filter may be excluded from contractor requirement as the system may need to be test in the factory.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and Drawings. Provide sufficient clearance for calibration and maintenance access.
- B. Do not install products until major construction is complete and building interior is enclosed and environmentally conditioned.
- C. Connect input and output devices as shown on Drawings.
- D. Provide complete programming, testing and verification of the programmable controller and associated inputs and outputs, including work required to interface with the existing City of Houston system.

3.03 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems under provisions of Section 01755 - Starting Systems.

3.04 DEMONSTRATION

- A. Provide systems demonstration under provisions of Section 01770 - Closeout Procedures.
- B. Demonstrate operation and programming of controller. Provide two sessions of four hours of instruction each for four persons, to be conducted at project site with manufacturer's representative.
- C. System demonstration shall include the following:
 - 1. Complete verification of field wiring.
 - 2. Complete verification of system software.
 - 3. Demonstration of functionality of each discrete input and output by simulation of actual field device action.
 - 4. Demonstration of functionality of each analog input and output by actual variations in the process variable (e.g. flow, level, etc.).
 - 5. Complete demonstration of each alarm by simulation of actual field device action.

6. Complete demonstration and verification (level, flow, and status/alarm points) of 2-way communication with City of Houston Central Monitoring Facility.

3.05 TRAINING

- A. Provide engineering and programming schools preferably at the Houston offices of the PLC manufacturer or distributor or at the manufacturer's factory as specified below. This training shall be performed by fully-qualified and manufacturer-certified training personnel who can clearly illustrate experience in teaching previous courses. Obtain approval from the Owner's representative for training facility and course outline before scheduling training.
- B. If such training is provided somewhere other than Houston, then the system supplier shall provide coach airfare (weekday travel), motel expenses (\$95.00/day/person), rental cars (\$50.00/day/2 people), and meal allowances \$35.00/day/person) for selected City personnel for the duration of the schools.
- C. Schedule classes at the City of Houston's convenience. The supplier should not assume that the City's personnel will attend these courses in a continuous and sequential manner. When training is submitted in voucher form, it shall be valid for a minimum of two years at no extra cost to the City.
- D. Training shall consist of the following as a minimum:
 1. PLC basic/advanced programming/maintenance (five days): Two people.
 2. HMI (Siemens TP900) basic/advanced programming (three days): Two people.

END OF SECTION

SECTION 13446

PRIMARY INSTRUMENTATION DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Ultrasonic level transmitter, flow meter, Hydrogen sulfide gas detector, Differential pressure transmitters, Diaphragm seals, power transformers, phase/voltage monitor relay, terminal blocks, surge protections, and accessories for use with control panels and instrumentations.

1.02 REFERENCES AND STANDARDS

- A. NEMA ICS 1 - General Standards for Industrial Controls and Systems.
- B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.
- C. NEMA ICS 3 - Industrial Systems.
- D. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- E. NFPA 70 - National Electrical Code (NEC).
- F. Underwriters Laboratories, Inc. (UL).
- G. ANSI B40.1 - Gauges, Pressure Indicating Dial Type Elastic Element.

1.03 SUBMITTALS

- A. Comply with Section 01330 - Submittal Procedures.
- B. Submit shop drawings indicating layout of completed assemblies, interconnecting cabling, dimensions, weights and external power requirements.
- C. Submit product data for each component specified.
- D. Submit manufacturer's certificate that all equipment meets or exceeds specified requirements. Submit manufacturer's installation instructions.

1.04 PROJECT RECORD DOCUMENTS

PRIMARY INSTRUMENTATION DEVICES

- A. Submit record documents under provisions of Section 01770 - Closeout Procedures.
- B. Accurately record actual locations of controller cabinets and input and output devices connected to system. Include interconnection piping, wiring and cabling information, and terminal block layouts in controller cabinets.
- C. During drawing submittal phase, submit detailed programming information consisting of ladder logic and line code of proposed program, and complete input, output, relay, register and controller identification labels.
- D. Submit factory testing procedures proposed to verify input, output, PID loop and register operations, system logic verification, and spare memory capacity.

1.05 OPERATION AND MAINTENANCE DATA

- A. Submit operation in accordance with Section 01782 - Operations and Maintenance Data.

1.06 QUALIFICATIONS

- A. Manufacturer: A company specializing in manufacturing the products specified in this Section having at least 3 years documented experience maintaining service facilities within 100 miles of project and having proven compatibility with existing City wastewater facilities. Like devices shall be of the same Manufacturer.

1.07 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70 (NEC).
- B. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and shown; install in accordance with UL requirements.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in factory-sealed containers. Store, handle and protect products under provisions of Section 01610 - Basic Product Requirements.
- B. Upon delivery, inspect products for damage.
- C. Store products in clean, dry area; maintain temperature in compliance with NEMA ICS 1.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature above 32 degrees F and below 104 degrees F during and after installation of products.
- B. Maintain area free of dirt and dust during and after installation of products.

PART 2 P R O D U C T S

2.01 Ultrasonic Level Transmitter (Chemical tanks)

- A. Manufacturer:
 - 1. Siemens: Model SITRANS Probe LU.
 - 2. Or approved equal.
- B. Description: 2-wire loop powered ultrasonic transmitter for level. The transducer is available as ETFE (ethylene-tetrafluoroethylene) or PVDF (polyvinylidene fluoride) to suit the chemical conditions of each tank.
- C. Range: 0.3 m (1 ft) to 15 m (50 ft).
- D. Power: 12-30 V DC 20W
- E. Temperature: -20 to +50 °C (-5 to +122 °F)
- F. Accuracy: 0.15 % of span.
- G. Beam angle: 10 degree at -3 db boundary.
- H. Memory: non-volatile EEPROM, no battery required.
- I. Communication: 4-20mA HART.
- J. Output: 0-20 mA, 4-20 m 550 ohm maximum.
- K. Spare Unit: Provide a spare unit in addition to the unit installed.
- L. Warranty: 18 months minimum from the time acceptance by City.
- M. Accessories: The level probe shall be installed with a flange adaptor.

PRIMARY INSTRUMENTATION DEVICES

2.02 TRANSIT TIME/DOPPLER FLOW METER (CHEMICAL FEED SYSTEM)

1. Flow Element

a. Type:

- 1) Transit time type.
- 2) Strap on sensor design.

b. Function/Performance:

- 1) Accuracy: Plus or minus 1.6 percent of reading flow from 0.03 FPS to full scale.
- 2) Operating Temperature: Minus 22 degrees Fahrenheit to plus 266 degrees Fahrenheit

c. Physical:

- 1) Sensors shall be mounted diagonally across from each other and shall be mounted through special windows. Sensors housing shall be stainless steel.

d. Options/Accessories Required:

- 1) Each flow meter assembly (sensor and transmitter) shall be factory calibrated. The calibration report shall be included in the final O & M manual.

e. Manufacturer(s):

- 1) Flexim Model 7407
- 2) No substitution

2. Transmitter/Converter

a. Type:

- 1) Electronic, microprocessor based, match to flow element.

b. Function/Performance:

- 1) Accuracy: See flow element.
- 2) Operating Temperature Range: Plus 14 degrees F to 140 degrees F.
- 3) Output: 0/4-20 ma.
- 4) Power Requirements: 120 V, 60 Hz.
- 5) Diagnostics: Sound Velocity, Signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times
- 6) Circuitry: Solid state microprocessor based. Battery memory backup in case of power failure.

c. Physical:

- 1) Enclosure: NEMA 4X.

d. Options/Accessories Required:

- 1) Provide a local indicator with scale engraved in engineering units of flow.
- 2) The totalizer can only be reset to zero manually.
- 3) Provide all manufacture interconnecting cable, connectors and fittings between the transmitter/converter and the flow sensors.

e. Manufacturer(s):

- 1) Supplied with flow element.

2.03 HYDROGEN SULFIDE GAS DETECTOR

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. MSA International Ultima XIR
2. Honeywell
3. Scott

PRIMARY INSTRUMENTATION DEVICES

4. Approved Equal
- B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
- C. General
1. Provide sufficient lengths of Manufacturer's specialty cables for installation of power and signal conductors as provided with each instrument.
- D. Type
1. 316 Stainless Steel
 2. Infrared dual-wavelength, Heated-Optics.
 3. Electronic, microprocessor based
 4. Continuous, dual channel
 5. Hydrogen Sulfide Level indicator
- E. Function/Performance
1. Sense the presence of hydrogen sulfide gas prior to reaching toxic levels.
 2. Provide early warning indication to personnel.
 3. Response Time: Less than 10 seconds to 90% of final reading from a step change in gas concentration.
 4. Range: 0-50 PPM.
 5. Alarm Settings: Field adjustable.
 6. Temperature Limits: 0 to 50 degrees C (32 to 122 degrees F).
 7. Sensor Life: Three (3) years.
 8. Minimum of two contacts to alert personnel of gas concentration levels.
 9. Front mounted power-on and high alarm indicating lights.
 10. Indicating meter graduated in Parts per Million (PPM) Hydrogen Sulfide.
 11. Minimum two output contacts for remote indications as shown on the Drawings.
 12. ModbusRTU Communication Interface to Controller.
- F. Physical
1. Housing: Class 1, Div. 1, Groups A, B, C and D.
 2. Infrared technology.

3. Wall mounting with sensor remote from indicating transmitter.
 4. Shielded two-wire or three-wire sensor-to-controller wiring.
 5. Adjustable alarm setting.
 6. Local Indication.
- G. Power Requirements
1. 24vdc
- H. Options/Accessories
1. Provide an integral indicator scaled in engineering units.
 2. Provide hand held programmer(s) where full setup is not available for the instrument

2.04 DIFFERENTIAL PRESSURE TRANSMITTERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
1. Rosemount
 2. Endress + Hauser
 4. Approved Equal
- B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
- C. General
1. Provide signal surge protection at all transmitters.
- D. Type
1. Microprocessor based intelligent type.
 2. Diaphragm actuated.
- E. Function/Performance:
1. Output: 4-20 mA DC. Output shall be linear for pressure applications.
 2. Accuracy: 0.1 percent of span (linear output).
 3. Stability: Combined temperature effects shall be less than 0.2 percent of maximum span per 50 degrees F temperature change. Effect on accuracy due to static pressure changes shall be negligible.
 4. RFI Protection: 0.1 percent error between 27 and 500 MHZ at 30 v/m field intensity.

PRIMARY INSTRUMENTATION DEVICES

5. Drift: 0.10 percent per six months for 4-20 mA output.
6. Sensor Technology: Digital.
7. Over Range Protection: Provide positive over range protection.

F. Physical

1. Electrical Classification: Intrinsically safe for Class I and Class II, Division 1 locations.
2. Enclosure: NEMA 4X.
3. Sensor Diaphragm Material: 316 Stainless Steel alloy or Hastelloy C.
4. Gaskets: Teflon.
5. Sensor Fill Fluid: Shall be suitable for process fluid being measured. When used for chemical metering service, sensor fill fluid shall be rated specifically for the chemical being measured.

G. Power Requirements:

1. Loop powered, two wire type.

H. Required Options/Accessories

1. Provide span and zero adjustment at each transmitter.
2. Provide local indication at each transmitter using LCD readout. Scale shall be in engineering units. With a minimum of 4 digits of precision
3. For each transmitter provide a manifold as specified herein, with the following Modes:
 - a. Normal Mode
 - b. Zeroing Mode
 - c. Isolation Mode
 - d. Calibration Mode
 - e. Blowdown Mode
4. Provide hand held programmer(s) where full setup is not available for the instrument directly from the display.

2.05 DIAPHRAGM SEALS- THREADED

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
1. Red Valve Company, Inc.
 2. Ashcroft.
 3. Approved equal

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. General

1. Rating to match pipe rating.

D. Type

1. Thread attached.
2. Welded Metal Diaphragm.
3. Exposed Surfaces - 316 stainless steel.

E. Function/Performance

1. Purpose: To protect instruments or gauges from the process medium.
2. A flexible diaphragm shall separate the process medium from the instrument element. Space on the instrument side of the diaphragm shall be completely filled with a suitable silicone or instrument oil. The process pressure is transmitted by the liquid filled system to the instrument element.
3. Filling Screw: Include on all units.
4. Pressure Limits: 1,000 psi.
5. Flushing Connection: Include on all units.
6. Capillary tubing as required.

F. Physical

1. Top Housing: Carbon Steel, Cadmium plated.
2. Diaphragm: 316 ELC Stainless Steel.
3. Exposed Surfaces: 316 stainless steel.
4. Bolts, Nuts and Plugs: 18-8 stainless steel or 316 stainless steel.
5. Capillary: 1/4-in stainless steel armor shielded.

G. Power Requirements

1. None

H. Required Options/Accessories

2.06 CONTROL POWER TRANSFORMERS

- A. Transformer: NEMA ST 1 machine tool transformer with isolated secondary winding.

PRIMARY INSTRUMENTATION DEVICES

- B. Power Rating: 250 VA or 200 percent power requirement, whichever is greater.
- C. Voltage Rating: 480/240 volt primary, 120 volt secondary, single phase.

2.07 PHASE/VOLTAGE MONITOR RELAY

- A. Manufacturer, Product: Diversified Electronics Inc.; Model PBD Series or approved equal.
- B. Description: All three phases monitored individually for preselected under and over voltage limit phase loss, phase unbalance, phase reversal, frequency shift and phase shift. Automatic reset after adjustable release delay when line conditions return to normal.
- C. Indicators: LED indicators for under and over voltage limit.
- D. Output Rating: DPDT, 3 amps resistive at 600 VAC.
- E. Phase Sequence: ABC.
- F. Sampling Time: 2 seconds.
- G. Spare Unit: In addition to the unit installed, furnish one spare phase/voltage monitor relay.

2.08 TERMINAL BLOCKS

- A. Manufacturers
 - 1. Bussmann.
 - 2. Phoenix Contact.
 - 3. General Electric Company.
 - 4. Weidmuller.
 - 5. Allen Bradley.
 - 6. Schneider Electric
- B. Substitutions: Comply with Section 01630 - Product Substitution Procedures.

- C. Terminal Blocks: Provide isolated fused snap-on type terminal blocks.
- D. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- E. Signal and Control Terminals: Modular construction type suitable for channel mounting with tubular pressure screw connectors; 300 volt rating.
- F. Provide color-coded (green/yellow) ground bus terminal block, with each connector bonded to enclosure.

2.09 ACCESSORIES

- A. Plastic Raceway: Plastic slotted wireway with snap-on locking covers.
- B. Manufacturer
 - 1. Anixter Bros., Inc.
 - 2. Delaware Industries, Inc.
 - 3. Panduit Corp.
 - 4. Iboco

PART 3 EXECUTION

3.01 INSTALLATION

- A. Furnish complete enclosure, factory tested and ready for installation and field termination.
- B. Terminate wiring with spade lugs at terminal strips corresponding to designations on Drawings.
- C. When not installed in plastic wireways, such as along back of door, neatly bundle and support air tubing and internal panel wiring with self-adhesive nylon clips. Provide adequate slack for proper door operation without damage to wiring or tubing.
- D. Identification: Identify system components in accordance with Section 16195 - Wiring and Conduit Identification.

PRIMARY INSTRUMENTATION DEVICES

- E. Furnish and install as shown on the drawing for Bio Trickling Filter, and Odor system PLC panel.
 - 1. Identify conductors and termination points (device and relay terminals).
 - 2. Identify transmitters, switches and devices with stainless steel tags.
 - 3. Provide nameplates for panel-mounted devices and instruments as shown on Drawings.

3.02 SYSTEM TESTING

- A. Perform system testing as required by individual component Sections. Calibrate and adjust components for proper operation. Submit 6 copies of Manufacturer's Installation Inspection, Field Calibration and Field Testing Reports. Replace components found to be defective.

END OF SECTION

SECTION 13471

CONTROL CABINET ENCLOSURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Indoor and outdoor control cabinets for Odor system, and BTF system instrumentation and control panels. Contractor shall provide submittal and specify equipment per drawing and equipment and device layout required for a fully functional system.

1.02 REFERENCES

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. ANSI/NFPA 70 - National Electrical Code (NEC).
- C. Underwriters Laboratories, Inc. (UL).
- D. Factory Mutual (FM).
- E. Occupational Safety and Health Administration (OSHA).
- F. American National Standards Institute (ANSI).

1.03 SUBMITTALS

- A. Conform to Section 01330 - Submittal Procedures.
- B. Product Data: Provide manufacturer's product literature and specifications.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Paragraph 1.04, Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70 (NEC).

CONTROL CABINET ENCLOSURES

- B. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and shown; install in accordance with UL requirements.

1.05 EXTRA MATERIALS

- A. Insert half-size blackline prints on rite in the rain all weather writing paper model 8511 of the complete wiring diagrams, schematics, and loop diagrams applicable to each control panel in a clear plastic envelope and store in a suitable print pocket or holder inside each control panel.

PART 2 P R O D U C T S

2.01 MANUFACTURERS

- A. Acceptable Manufacturers
 1. Rittal
 2. Hennessey Products, Inc.
 3. Hoffman Engineering.
 4. Hammond Manufacturing
 5. The EMF Company.
 6. Rose Enclosure.
 7. Weigman Company.
 8. N.E.M.A. Enclosure Mfg. Co.

- B. Substitutions: Comply with Section 01630 - Product Substitutions and Procedures.

2.02 OUTDOOR CONTROL CABINETS

- A. Enclosures: NEMA 3 type 5052-H32 aluminum with 0.125 inch thickness 5052-H32 aluminum back panel for mounting components. If requested by City Engineer, obtain inspection and approval by Underwriters Laboratory, Inc., after installation of control system in cabinet.
- B. Enclosure Size: As indicated on Drawings, as required to accommodate equipment and as indicated in UL standards.

- C. Material: Exterior and interior enclosure doors, shelves and component enclosures: Fabricate of 14 gauge type 316 stainless steel or 0.125 inch thick type 5052-H32 aluminum.
- D. Doors: Stainless steel pan-type construction, with full-length stainless steel piano hinge (for stainless steel or aluminum). Equip exterior door with padlock, heavy-duty locking pistol-grip handles and 3-point latching mechanism of the draw roller type (0.750 inch minimum diameter rollers). Handles shall be 3/4 inch minimum diameter stainless steel. Equip interior doors with flush quarter-turn closure devices. Equip interior and exterior doors with neoprene gaskets.
- E. Provide rain shield with 1 inch drip lip for outdoor cabinets to protect against direct sun radiation and rainfall. Design shield to provide 2-1/2 feet of cover front and back and 6 inches of cover on the sides. Design shield shall have a 1-inch open panel door clearance. Shielding material: Type 316 stainless steel or type 5052-H32 aluminum.
- F. Nameplates: On the outside of each cabinet's inner door, provide motor data nameplate information for each pump motor; copy all information exactly as shown on each motor nameplate. Provide engraved laminated plastic nameplates; black letters with white background; fasten to outside of cabinet door of each motor starter section with stainless steel screws. Provide nameplates for all devices within panel.
- G. In each cabinet section, provide a 120V convenience outlet and a switched 40 watt minimum fluorescent light fixture, with 0 degrees F ballast in each section.
- H. Inside and outside of cabinet shall be smooth and free from burrs.
- I. If aluminum cabinet, hinges shall be .090 inch thick minimum, aluminum, and shall have .250 inch diameter stainless steel hinge pin. Hinge leaves shall not be exposed externally when door is closed.
- J. NEMA 4X enclosures shall have all bolt holes gasketed.
- K. A divider of same material and thickness as the cabinet shall be added to divide electrical components and wiring from instrumentation and pneumatic components and wiring.

PART 3 EXECUTION

CONTROL CABINET ENCLOSURES

3.01 EXAMINATION

- A. Verify that surface and job conditions are ready for construction; report unsatisfactory conditions to the City Engineer. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Transport, handle and install products in accordance with manufacturer's instructions.
- B. Install on prepared pads. Anchor securely at each corner. Shim and grout as required to form a watertight seal.
- C. Install cabinet fronts plumb.
- D. Field-cut bottom conduit entrance openings for outdoor cabinets. Seal removable plates with silicone sealant.
- E. Install ground rod and equipment ground conductor.
- F. Install separate instrument ground lug and ground conductor; connect to common station ground grid.
- G. Mount devices to allow removal and reinstallation without backboard removal. Use stainless steel mounting hardware.
- H. Except for nameplate fasteners, mounting or other hardware shall not penetrate panel exterior.
- I. Exterior panels: Mount with stainless steel anchor bolts and ground to the station ground field. Install and test ground field to provide maximum 5 ohm resistance to ground in accordance with Section 16170 - Grounding and Bonding.
- J. Provide door restraints for outer and inner doors to positive lock and hold doors open at 115 degrees minimum.
- K. Label all wires with heat shrink markers per Section 16195.

END OF SECTION

Section 15010

BASIC MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. The applicable provisions of this Section shall apply to the following:
 - 1. Division 11 – Equipment, all sections.
 - 2. Division 13 – Special Construction, equipment and special construction sections.
 - 3. Division 14 – Conveying Systems, all sections.
 - 4. Division 15 – Mechanical, all sections.
- B. Drawings are diagrammatic only and do not provide fully all dimensioned locations of various elements of work. Determine exact locations from field measurements.
- C. Where the work “concealed” is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces, or suspended ceilings. “Exposed” is understood to mean open to view.

1.03 REFERENCE STANDARDS

- A. Materials specified by reference to standards of ASTM, ANSI, AWWA, ASME, TxDOT, Federal, or other standard organizations must comply with latest edition (except where specified otherwise in individual sections by noting year or edition) in effect on date bids are received.
- B. Requirements in referenced standards established minimum requirements for all equipment, materials, and work. For instances where capacities, size, or other feature of the equipment, devices, or materials exceed these minimums, meet the listed or requirements specified in the Drawings and Specifications.

1.04 CODE REQUIREMENTS AND PERMITS

- A. Perform work in accordance with applicable statutes, ordinances, codes, and regulations of governmental authorities having jurisdiction.
- B. Resolve code violations discovered in Contract Documents with ENGINEER prior to award of Contract. After award of Contract, CONTRACTOR shall make any correction or addition necessary for compliance with applicable codes at no additional cost to OWNER.
- C. CONTRACTOR shall obtain and pay for all permits and licenses, pay all fees, and obtain all certificates of inspection and other permits required to place Work in operation.

1.05 OPERATION AND MAINTENANCE

- A. Provide required copies of operation and maintenance data when designated in the individual sections in accordance with Division 1 Section 01782 “Operation and Maintenance Data.”
- B. Provide the services of qualified manufacturers’ representatives when designated in the individual sections in accordance with Division 1 Section 01640 “Manufacturers’ Representative.”

1.06 FACILITY STARTUP, DEMONSTRATION, AND TRAINING

- A. Provide services of manufacturers' representatives, as well as qualified personnel, when designated in the individual sections for equipment and system testing and facility startup in accordance with Division 1 Section 01810 "Equipment Testing and Facility Startup."
- B. Provide qualified personnel and manufacturers' representatives for the training of OWNER'S personnel and for the demonstration of facility operation in accordance with Division 1 Section 01820 "Demonstration and Training."

1.07 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the applicable code for the materials and work involved:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code – Steel"
 - 2. AWS D1.2/D1.2M, "Structural Welding Code – Aluminum"
 - 3. AWS D1.3, "Structural Welding Code - Sheet Steel"
 - 4. AWS D1.4, "Structural Welding Code - Reinforcing Steel"
 - 5. AWS D1.6, "Structural Welding Code – Stainless steel"
- B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Welding procedures and testing shall comply with ANSI B31.1.0, "Standard Code for Pressure Piping, Power Piping," and the AWS Welding Handbook.
- D. Soldering and Brazing Procedures shall conform to ANSI B9.1, "Standard Safety Code for Mechanical refrigeration."
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.08 PROJECT CONDITIONS

- A. Division 1 Section "Product Requirements" or Division 1 Section 01010 "Construction General Requirements" paragraph titled "Product Requirements," which ever is applicable, provides the administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products. These requirements are in addition to requirements specified in the individual sections.
- B. Division 1 Section "Execution Requirements" or Division 1 Section 01010 "Construction General Requirements" paragraph titled "Execution," which ever is applicable, provides the general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. General installation of products.
 - 4. Progress cleaning.
 - 5. Starting and adjusting.
 - 6. Protection of installed construction.
 - 7. Correction of the Work.

1.09 WARRANTY

- A. Special Warranty: Special warranties, in addition to the one year general construction warranty, are specified in various Sections. The special warranty time period starts with the date of Substantial Completion, unless specified otherwise.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Furnish new and unused materials, products, and equipment of domestic manufacturer, unless otherwise specified. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.
- B. Product selection procedures and substitution procedures are described in Division 1 Section 01600 "Product Requirements" or Division 1 Section 01010 "Construction General Requirements" paragraph titled "Product Requirements," which ever is applicable.
- C. Motors
 - 1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in applicable motor sections of Division 11.
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven loads will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 16 Sections.
- D. Control Panels: Equipment manufacturer furnished control panels shall comply with the requirements of Division 11 Section 11009 "Common control Panel Requirements for Equipment."

2.02 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.03 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced, or transmitted to or through the building structure by equipment, piping, ducts, or other parts of Work, rectify such conditions without additional cost to OWNER.
- B. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate (without cost to OWNER) that equipment performs within designated limits specified in Division 15 Section 15958 "Mechanical Equipment Testing."

2.04 CONCRETE

- A. Material: Class "B" concrete mixture for equipment and structural support bases.

2.05 STRUCTURAL MATERIAL

- A. Construct floor stands of structural members or steel pipe as designated in Division 5 Section 05500 "Metal Fabrications."
- B. Work Platforms. Provide as shown on the Drawings and in accordance with Division 5 Section 05512 "Metal Work Platforms."
- C. Anchor Bolts. Unless otherwise designated provide Type 316 stainless steel in accordance with Division 5 Section 05501 "Anchor Bolts, Expansion Anchors, and Concrete Inserts."

2.06 MASTER EQUIPMENT LIST (MEL)

- A. Provide a MEL during the progress of the Work. Include the following representative items, but do not limit to, valves, controls, instruments, electrical; or control panels, switchgear, transformers, equipment, pumps, material handling devices, and related items and devices.

- B. Prepare the MEL in accordance with the format as described below.
 - 1. Column 1 – Tag Number
 - 2. Column 2 – Item of Equipment
 - 3. Column 3 – Location
 - 4. Column 4 – Specification Reference
 - 5. Column 5 - Manufacture (Supplier)
 - 6. Column 6 – Model, Serial Number, and Other Information
 - 7. Column 7 - Remarks

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Space Requirements. Consider space limitations imposed by contiguous work, including clearances required for service, in selection and location of equipment, products, and materials. Do not provide equipment, products, or materials which are not suitable in this respect.
- B. Obstructions:
 - 1. The Drawings for work associated with existing facilities, indicate certain information pertaining to surface and subsurface obstructions obtain from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 2. Before any cutting or trenching operations are begun, verify with Owner's Representative, utility companies, municipalities, and other interested parties that all available information has been provided. Verify locations of existing work have been given.
 - 3. Should obstruction be encountered, whether shown or not, after routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing service, structures, and facilities in a satisfactory and serviceable conditions.
 - 4. Assume responsibility for and repair any damage to existing utilities, structures, or facilities, whether or not such existing facilities are shown on the drawings.
- C. Rough In:
 - 1. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
 - 2. Refer to equipment specifications in Divisions 5 through 17 for rough-in requirements.
- D. Job Conditions:
 - 1. Examine the areas and conditions under which the Work will be performed.
 - 2. Where ducts, pipes, and other mechanical work are shown in conflict with locations of structural members, electrical, other equipment and related items, include labor and materials required for extensions, offsets, and supports to clear the encroachments.
 - 3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation.
 - 4. Verify all dimensions and distances. No additional compensation will be allowed because of differences between work shown on the Drawings and actual dimensions and distances at the jobsite.
- E. Preparation and Coordination With Other trades:
 - 1. Perform coordination work associated with Division 15 Mechanical in accordance with provisions of specifications, shop drawings, and Drawings, as well as the following:
 - a. Coordinate as necessary with other trades to assure proper and adequate interface with all the Work.

- b. Coordinate accepted equipment changes from those scheduled or specified with other trades affected. Additional compensation to other trades for equipment changes are the responsibility of the contractor making the change.
2. The mechanical drawings are diagrammatic, but are required to be followed as closely as actual construction and work of other trades will permit. Duct and piping arrangement have been designed for maximum economy consistent with good practice and other considerations. Install the systems arranged as shown on the Drawings, except as otherwise approved in advance by the Owner's Representative.
3. Where items such as diffusers, thermostats, switches, control panels, and related work are not specifically located on the Drawings, locate as determined in the field by the Owner's Representative. When such items are installed without such specific direction, relocate as directed by the Owner's Representative and at no additional cost to the OWNER.

3.02 MECHANICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
 1. Coordinate mechanical systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.
 9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
 11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- B. Protection: Adequately protect work, equipment, fixtures, and materials. At completion of Project, all work shall be clean and in good conditions.
- C. Air Filters and Pipe Strainers: Immediately prior to Final Acceptance of Project; inspect, clean and service air filters and pipe strainers. Replace disposable type air filters.
- D. Lubrication, Refrigerant, and Oil:
 1. Provide a complete charge of correct lubricant and oil for each item of equipment.

2. Provide complete and working charge of proper refrigerant for each refrigerant system. After each system has been in operation long enough to ensure balance operating conditions, check the charge and modify it for proper operation as required.
- 3.03 EQUIPMENT AND STRUCTURAL FOUNDATIONS AND SUPPORTS
- A. Concrete Pads: Unless otherwise shown on the Drawings, pour equipment concrete pads, 4-inch thickness minimum, on roughened floor slabs. Reinforced concrete pad with No. 4 rebar set 12 inches on center, with 2-inch clearance between top of pad and rebar. Extend outer edges of concrete pad a minimum of 2 inches beyond equipment.
 - B. Structural Supports: Anchor structural supports on 4-inch minimum concrete pads. Adjust height of concrete pads as required to accommodate floor slopes and height of platforms and related work.
 - C. Ceiling-Mounted Equipment: Hang from suitable brackets, platform framing or similar supports fabricated of structural members. Apply designated protective coating system in accordance with Division 9 Section 09910 "Painting and Protective Coatings."
- 3.04 CUTTING AND PATCHING
- A. General:
 1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
 2. Accomplished cutting and patching operations as shown on the Drawings and described in the Specifications and in accordance with Division 1 Section 01731 "Cutting and Patching," if applicable.
 - B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 1. Remove and replace Work not conforming to requirements of the Contract Documents.
 2. Remove and relocate equipment and materials in existing structures.
 - C. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- 3.05 SELECTIVE DEMOLITION
- A. When designated on the Drawings, accomplish selective demolition of equipment, structures, facilities, and related work in accordance with the Division 1 Section 01732 "Selective Demolition," if applicable.

END OF SECTION

Section 15015

PIPING SYSTEMS, BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section specifies piping materials and installation methods common to the piping system Sections of Division 15 and includes joining materials, piping specialties, and basic piping installation instructions. This Section includes:
 - 1. All exposed, submerged, and buried plant and station piping including modifications to existing systems as well as new pipe systems, except systems specified in related work.
 - 2. Potable water and raw water mains, sanitary sewers, storm drains and culverts serving plant or station and shown on Drawings.
 - 3. Floor and sanitary drain systems within building limits are not included.
 - 4. Domestic water distribution systems, sanitary sewage systems, and storm drainage systems are covered in other Sections.
 - 5. CONTRACTOR shall mark actual flowline or top of pipe elevations and actual coordinates on record drawings when pipelines are being installed.
- B. Related Sections:
 - 1. Division 2 Section 02317 "Excavation and Backfill for Utilities" for the excavation, trenching, and backfilling for buried piping systems.

1.03 REFERENCES AND DEFINITIONS

- A. References:
 - 1. American National Standards Institute (ANSI):
 - a. B9.1 Standard Safety Code for Mechanical Refrigeration
 - b. B31.3 Process Piping Code
 - 2. ASTM International (ASTM):
 - a. A 53 – Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - b. B 32 – Specification for Solder Metal
 - c. B 813 – Specification for Liquid and Paste Fluxes for Soldering Copper and Copper Alloy Tube
 - d. B 828 – Practice for Making Capillary Joints by Soldering of copper and Copper Alloy Tube and fittings
 - e. C 1173 – Specification for Flexible Transition Couplings for underground Piping Systems
 - f. D 1785 – Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - g. D 2564 – Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping systems
 - h. D 2672 – Specification for Joints for IPS PVC Pipe Using Solvent Cement
 - i. D 2846 – Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water distribution Systems
 - j. D 2855 – Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
 - k. D 3139 – Specifications for Joints for Pressure Pipes Using Flexible Elastomeric Seals

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- l. D 3212 – Specification for Joints for Drain and Sewer Pipes using Flexible Elastomeric Seals
 - m. E 814 Test Method for Fire Tests of Through-Penetration Fire Stops
 - n. F 402 – Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining thermoplastic Pipe and Fittings
 - o. F 656 – Specifications for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
 - p. F 493 – Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
 - q. F 593 – Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
 - r. F 594 – Specification for Stainless Steel Nuts
 3. American Society of Mechanical Engineers (ASME):
 - a. A13.1 Scheme for Identification of Piping Systems
 - b. B1.20.1 Pipe Threads, General Propose, Inch
 - c. B16.21 Nonmetallic Flat Gaskets for Pipes Flanges
 - d. B18.2.1 Square and Hex Bolts and Screws, Inch Series
 4. American Welding Society (AWS):
 - a. A5.8 Specification for Filler Metals for brazing and Braze Welding
 - b. D1.1 Structural Welding Code Steel
 - c. D10.12 Guide for Welding Mild Steel Pipe
 5. American Waterworks Association (AWWA):
 - a. C110 – Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm) for Water
 - b. C219 – Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe
 6. National Sanitation Foundation (NSF):
 - a. NSF/ANSI 61 – Drinking Water Components – Health Effects
 - B. Definitions:
 1. Piping Systems: Includes all piping, fittings, valves, specials, hangers and supports, and related items required for a complete piping system.
 2. Ferrous Metal: Iron, steel, stainless steel, and alloys with iron as principal component.
 3. Nonmetallic: PVC, CPVC, PE, HDPE, and FRP.
 4. Nonferrous Metals: Copper
 5. Wetted or Submergence:
 - a. Submerged, or less than one foot above the maximum liquid surface of water holding structures.
 - b. Below top of channels, under cover of slabs of channels or tanks.
 - c. In other damp or covered locations (e.g., vaults, wetwells, utility corridors, etc.)
 6. Exposed or Atmospherically Exposed Piping Systems: All piping systems exposed to the atmosphere (not buried, submerged, wetted or embedded). This designation includes insulated piping inside chases, or piping hidden from view.
 7. Texas Administrative Code (TAC):
 - a. Chapter 217 –Design Criteria for Sewerage Systems
 - b. Chapter 290 Subchapter D – Rules and Regulations for Public Water Systems

1.04 SYSTEM DESIGN DESCRIPTION

- A. General:
 1. The Drawings and Specifications are not all inclusive of explicit piping details; provide piping in accordance with the laws and regulations and intended use, including:
 - a. Power Plant Piping: ANSI/ASME B31.1 Code.
 - b. Building Service Piping: ANSI/ASME B31.9 Code, as applicable.
 - c. Sanitary Building Drainage and Vent Systems: ICBO/APMO Uniform Plumbing Code.
 2. Buried Piping: Provide to be suitable for design conditions as follows:

- a. H20-S16 traffic load (AASHTO Standard Highway Specifications for Bridges) with 1.5 impact factor.
 - b. Piping both with and without internal pressure.
 3. Hangers and Support Systems: Provide an engineered system in accordance with Division 15 Section "Hangers and Supports for Piping Systems."
 4. Pressure Testing and Disinfection of Pipelines: Refer to Division 15 Section "Field Testing of Plant and Station Piping Systems" for testing of gravity and pressure piping systems; the disinfection of potable water systems; and to the individual piping system Sections for specific requirements.
- B. Design Requirements:
1. The configuration and layout of various piping systems are shown in the Drawings. The types of pipe and joints, and embedment (if buried) to be used for each system are shown on the drawings or included in the appropriate specification Sections.
 2. In certain locations, pipe supports, anchors, and expansion joints have been indicated on the drawings, but no attempt has been made to indicate every pipe support, anchor, and expansion joint.
 3. It shall be the CONTRACTOR'S responsibility to provide a complete system of pipe supports, to provide expansion joints, and to provide restraints and anchor all piping, in accordance with the requirements set forth herein. Additional pipe supports may be required adjacent to expansion joints, couplings, or valves.
 4. Pipe and fittings shown on yard piping drawings are general in nature. CONTRACTOR shall determine exact lengths and fittings required and make field adjustments necessary to complete piping and avoid conflicts.
 5. Changes to the plan and profile of piping shall be submitted to ENGINEER for approval.
- C. Restrained Pipe and Fitting Joints, Buried Piping:
1. Restrained joints shall be used for a sufficient distance from each bend, tee, elbow, plug, or other fitting to resist thrust that will develop at the design pressure.
 2. CONTRACTOR shall provide restraint length calculations in accordance with AWWA M41 based on the laying conditions, soil conditions, depth of cover, and pressures to determine the number of restrained joints that will be required.
 3. For the purposes of thrust restraint, design pressures shall be the working pressure shown, plus the additional surge allowance for potable water, service water, and pump discharge piping. The design pressure shall be 1.5 times the design test pressure indicated for all other piping.

1.05 SUBMITTALS

- A. Product Data: Submit product data on each product item to be installed.
- B. Shop Drawings: Provide shop drawings for piping systems, organized by plant areas or individual piping systems. Prepare drawings to scale (1/4-inch = 1-foot 0-inch minimum), with the following information:
 1. Type of piping including materials, fittings, weights, linings, and coatings. A code or key to product data sheet may be used.
 2. Location and type of joints, fittings, taps, supports, restraint systems, kickers, and blocking (as applicable). Identify by catalog number or shop drawing detail number.
 3. Provide information on interior linings and exterior coatings.
 4. Identify the exact number of restrained joints, as well as the length of restrained joint piping for pressure buried piping.
- C. Specials: Provide fabrication drawings for specials including fabricated fittings, wall pipes, and wall sleeves. Show dimensions and materials of construction.
- D. Before starting fabrication, CONTRACTOR shall provide ENGINEER with pipe design calculations, the proposed engineered hanger and support systems, and specials, which shall incorporate the following information:

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1. Laying plan identifying all restrained joints, details of standard pipe section, special fittings, pipe supports, and bends.
 2. Piping components shall be numbered or otherwise sequence designated.
 3. Outlets and bends shall be made up into special lengths so that, when installed, they will be located as indicated.
 4. Each pipe and fitting shall be marked indicating class of pipe and location number in pipe laying plan. Markings shall be coded to the Shop drawings.
- E. Quality Control Submittals:
1. Welding certificates.
 2. Field Test Reports: For each pressure testing of piping systems and field-testing specified in other piping systems sections.
 3. Affidavits:
 - a. Manufacturer's Certificate of Compliance with reference standards.
 - b. Laboratory Testing Equipment: Certified calibrations, manufacturer's product data and test procedures.
 - c. Certified welding inspection and test results.

1.06 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code."
- B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
 3. Welding procedures and testing shall comply with ANSI B31.1.0, "Standard Code for Pressure Piping, Power Piping," and the AWS Welding Handbook.
 4. Soldering and Brazing Procedures shall conform to ANSI B9.1, "Standard Safety Code for Mechanical Refrigeration."
- C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the requirements of Division 1 Section 01600 "Product Requirements" and as described in the following paragraphs.
- B. Acceptance at Site:
1. General: Comply with manufacturer's instructions for unloading, storage, and handling at Project site.
 2. Delivery and Handling:
 - a. Do not deliver piping materials to project site prior to ENGINEER'S review of required submittals.
 - b. Unload and handle piping materials using proper material handling equipment. Use heavy canvas or nylon slings to lift pipe and fittings to protect coatings.
 - c. Do not drop, roll, skid piping materials.
 - d. Take such additional precautions as necessary to avoid damaging piping materials and coatings thereon.
- C. Storage and Protection:
1. Store piping materials in a manner that will reduce risk of damage.
 2. Block piping materials to prevent rolling.
 3. Protect materials from weather and sun as recommended by the manufacturer.
 4. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, and clay pipe. Maintain end-caps through

shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

5. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.
6. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping. Attach protectors over entire gasketed surface of flanges.
7. Flexible piping shall be stored in shaded area 24-hours prior to installation.

1.08 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings, construction contiguous with work, and related items by field measurements before fabrication.
- B. Flange Coordination: Coordinate the dimensions, hole drillings and type of flange face (flat or raised) of the flanges furnished with companion flanges of valves, pumps and equipment to be connected to or installed in the piping.
- C. NSF Certified: All surfaces and materials in contact with water or in contact with a chemical being added to water that is being treated for potable water use and conveyance, shall comply with the requirements of the Safe Drinking Water Act and shall conform to NSF-61. Product shall bear the mark or seal of an accredited testing laboratory.

1.09 COORDINATION

- A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.
- C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Division 3.
- D. Coordinate installation of piping systems with other trades; such as electrical, instrumentation, fire protection, and HVAC ducts.

PART 2 PRODUCTS

2.01 PIPING

- A. As specified in the various Division 15 Sections, the Piping Schedule, and as shown on the Drawings.
- B. Diameters Shown:
 1. Standardized Products: Nominal Size.
 2. Fabricated Steel Piping (Except Cement-Lined): Outside diameter, ASME B36.10M.

2.02 PIPE JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 2. AWWA C110, rubber, flat face, 1/8-inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Flange Bolts and Nuts:

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1. ASME B18.2.1, carbon steel, unless otherwise indicated.
 2. Exposed: ASTM A307, Grade B, hex head bolts; ASTM A563, Grade A or B, hex head nut; and ASTM F436 hardened steel washers. Corten acceptable for mechanical joints.
 3. Buried and Submerged: Type 316 stainless steel bolts; Type 316, hex head nuts and washers of the same material as bolts.
- C. Segmented Mechanical Couplings: Provide when designated on the Drawings or as an option to flanges for above ground piping, segmented mechanical couplings may be used.
1. Housing: Ductile iron conforming to ASTM A-536, grade 65-45-12, with orange enamel coating.
 2. Coupling Gasket: Grade "E" EDPM.
 3. Bolts and Nuts: Heat-treated plated carbon steel, trackhead meeting physical and chemical requirements of ASTM A-449 and physical requirements of ASTM A-183.
 4. Victaulic Style 77 standard flexible couplings or equivalent.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
1. CPVC Piping: ASTM F 493.
 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.03 TRANSITION FITTINGS

- A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
- B. Transition Couplings NPS 1-1/2 and Smaller:
1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
 2. Aboveground Piping: Specified piping system fitting.
- C. AWWA Transition Couplings NPS 2 and Larger:
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. Cascade Waterworks Mfg. Co.
 - b. Dresser, Inc.; DMD Div.
 - c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 2. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
- D. Plastic-to-Metal Transition Fittings:
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. Spears Manufacturing Co.

2. Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.
- E. Plastic-to-Metal Transition Unions:
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. Colonial Engineering, Inc.
 - b. NIBCO INC.
 - c. Spears Manufacturing Co.
 2. Description: CPVC and PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.
- F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:
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. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities.
 2. Description: ASTM C 1173 with elastomeric sleeve ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.04 INSULATING FLANGES, COUPLINGS AND UNIONS

- A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
1. 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. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Hart Industries, International, Inc.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Wilkins Div.
 2. Description: Factory fabricated, union, NPS 2 and smaller.
 - a. Pressure Rating: 150 psig minimum at 180 deg F unless otherwise specified.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.
- C. Dielectric Flanges:
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. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Water Technologies, Inc.
 2. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.
 - a. Pressure Rating: 150 psig minimum unless otherwise specified.

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- b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
 - 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. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Description: Non-conducting materials for field assembly of companion flanges, NPS 2-1/2 and larger.
 - a. Pressure Rating: 150 psig minimum unless otherwise specified.
 - b. Gasket: Neoprene or phenolic.
 - c. Bolt Sleeves: Phenolic or polyethylene.
 - d. Washers: Phenolic with steel backing washers.
- E. Dielectric Couplings:
 - 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. Calpico, Inc.
 - b. Lochinvar Corporation.
 - 2. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 and smaller.
 - a. Pressure Rating: 300 psig at 225 deg F unless otherwise specified.
 - b. End Connections: Threaded.
- F. Dielectric Nipples:
 - 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. Perfection Corporation.
 - b. Precision Plumbing Products, Inc.
 - c. Victaulic Company.
 - 2. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.
 - a. Pressure Rating: 300 psig at 225 deg F unless otherwise specified.
 - b. End Connections: Threaded or grooved.

2.05 CONNECTORS AND COUPLINGS

- A. General: Unless otherwise specified;
 - 1. Type 316 stainless steel bolts, fasteners, tie rods and accessories are required for connectors intended for buried, wetted, or submerged service.
 - 2. Carbon steel bolts, fasteners, tie rods and accessories are required in exposed atmospheric service. Coat items in accordance with Division 9 Section "Painting and Protective Coatings."
 - 3. Submerged couplings shall be stainless steel Type 316.
 - 4. Buried couplings may be epoxy coated steel or stainless steel Type 304 Depend-O-Lok.
- B. Elastomer Bellows Connector:
 - 1. Type: Fabricated spool, with single filled arch.
 - 2. Materials: Nitrile tube and neoprene cover.
 - 3. End Connections: Flange, 125-lb ANSI B16.1 standard, with elastomeric face and steel retaining rings.
 - 4. Working Pressure: 190 psig minimum, size 12-inch and smaller.

5. Thrust Restraint: Manufacturer designed control rods, fasteners, and accessories to limit travel of elongation and compression.
6. Manufacturers and Products:
 - a. Garlock; Style 204
 - b. Goodall rubber Co.
 - c. General Rubber Corp.
- C. Flexible Type Couplings (Steel and Stainless Steel Pipe):
 1. Design: Provide thrust ties across flexible couplings.
 2. Body and Middle ring: Carbon, Type 304, or Type 316.
 3. Followers: Ductile iron, malleable iron, Type 304, or Type 316.
 4. Bolts: Carbon steel, Type 304 or 316 stainless steel.
 5. Gaskets: EDPM
 6. Materials of construction of coupling, closure plates, end rings, and fasteners to match piping materials on which coupling is employed, as well as whether it is exposed, wetted or submerged service. Carbon steel components to have factory-applied fusion bonded epoxy coating (7MDFT).
 7. Manufacturer and Product:
 - a. Dresser; Style 128
 - b. Smith-Blair; Style 912
- D. Split Sleeve Couplings (Steel and Stainless Steel Pipe):
 1. Design: Double arch, with built-in thickened shoulders. Full joint restraint achieved for two times test pressure by weld-on end rings. Closure plates and sealing pad integral with coupling.
 2. Gaskets: EDPM O-ring style.
 3. Joint Deflection: Up to 2 degree.
 4. Carbon steel metal components to have factory-applied fusion bonded epoxy coating (7 MDFT).
 5. Materials of construction of coupling, closure plates, end rings, and fasteners to match piping materials on which coupling is employed, as well as whether it is exposed, wetted or submerged service.
 6. Manufacturer and Product: Victaulic, Inc.; Depend-O-Lok Model FxF, Type 2 Coupling, or equal.
- E. Flanged Coupling Adapters (FCA) (Ductile Iron and Steel Pipe):
 1. Design: Provide thrust across flexible coupling adapters.
 2. Body: Carbon steel conforming to AWWA C207.
 3. Flange: AWWA C207 or ANSI Standards.
 4. Bolts: Carbon steel, Type 304 or 316 stainless steel.
 5. Gaskets: EDPM.
 6. Carbon steel metal components to have factory-applied fusion bonded epoxy coating (7 MDFT).
 7. Materials of construction of coupling, closure plates, end rings, and fasteners to match piping materials on which coupling is employed, as well as whether it is exposed, wetted or submerged service.
 8. Manufacturer and Product:
 - a. Dresser; Style 128
 - b. Smith-Blair; Style 912
- F. Wedge Action Restraints (Ductile Iron and PVC Pipe):
 1. Design: Wedges and wedge actuating components are incorporated into the design of the follower gland.
 2. Material: Ductile iron, ASTM A536, Grade 65-45-12; wedges BHN 370 minimum.
 3. Nuts: Designed with torque-limiting twist-off nuts, exposing a bolt head sized to permit adjustment and removal of joint restraint.

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4. Chemical and nodularity test shall be performed as recommended by Ductile Iron Society on a per ladle basis.
5. Traceability: Provide material traceability records.
6. Coating:
 - a. Wedge Assembly: Two coats of liquid Xylan fluoropolymer, heat cured.
 - b. Casting Body: Polyester based powder, electrostatically applied and heat cured, providing corrosion, impact and UV protection.
7. Approvals:
 - a. Ductile Iron Pipe Restraints:
 - 1) Underwriters Laboratories: Size 3-inch through 24-inch.
 - 2) Factory Mutual: Size 3-inch through 12-inch.
 - b. PVC Pipe Restraints:
 - 1) Underwriters Laboratories: Size 4-inch through 12-inch.
 - 2) Factory Mutual: Size 4-inch through 12-inch.
 - 3) Size 4-inch through 24-inch comply with ASTM F1674.
8. Manufacturer and Product:
 - a. Ductile Iron Pipe: EBAA Iron Megalug 1100 series.
 - b. PVC Pipe: EBAA Iron Megalug 2000 PVC series.

2.06 PIPE SLEEVES

- A. Mechanical sleeve seals for pipe penetrations:
 1. Pipe to wall/casing penetration closures shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between pipe or conduit and wall/casing opening. Once expanded, the mechanical seal shall provide a watertight seal.
 2. Elastomeric element size and material shall be selected per manufacturer recommendations. Assemble with ASTM A276, Type 316 stainless steel bolts and nuts.
 3. Pressure end plates shall be either Type 316 stainless steel or manufactured of glass reinforced plastic, with a minimum tensile strength of 27,000 psi.
 4. Sized: According to manufacturer's recommendations for the size of pipe shown; to provide a watertight seal between pipe and wall sleeve opening.
 5. Available Manufacturers:
 - a. Advance Products & systems, Inc. (Innerlynx)
 - b. Pipeline Seal & insulator, Inc. (Link-Seal)
- B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
- D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
- G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped and smooth outer surface with nailing flange for attaching to wooden forms.
- H. Insulated and Encased Pipe Sleeve: Conforming to Pipe Shields, Inc.; Models WFB<WFB-CS and -CW Series, as applicable.
- I. Seepage Ring: Provide a seepage ring in middle of wall sleeve as follows:
 1. 3/16-inch minimum thickness, centered between sleeve ends for water stoppage on sleeves located in exterior or water bearing walls.
 2. Outside Diameter: 3 inches greater than pipe sleeve outside diameter.
 3. Continuously fillet weld on each side all around.

2.07 EXPANSION JOINTS

A. Elastomer Bellows:

1. Type: Reinforced, molded wide-arch.
2. End connections: Flanged, 125-lb ANSI B1.1 standard, with Type 304 stainless steel retaining rings.
3. Washers: Over the retaining rings to provide a leak proof joint under test pressure.
4. Thrust Protection: Manufacturer designed and supplied control rods, fasteners, and accessories to protect bellows from overextension at test pressures.
5. Tube and Bellows Arch Lining: EDPM.
6. Rated Temperature: 250oF.
7. Rated Deflection and Pressure:
 - a. Lateral Deflection: 3/4-inch minimum.
 - b. Burst Pressure: four times rated pressure.
 - c. Compression Deflection at Minimum Pressure: 1/2-inch at 250 psig.
8. Manufacturer and Product:
 - a. Holz Rubber Company, Inc.
 - b. Mercer Rubber Co.; Series 500
 - c. General Rubber Corp.
 - d. Goodall Rubber Co.

2.08 LININGS AND COATINGS

- A. Interior Pipe Linings: Prepare, prime, and finish pipe interior in accordance the applicable piping system Division 15 Sections and Division 9 Section 09910 "Painting and Protective Coatings."
- B. Exterior coatings: Prepare, prime, and finish pipe exterior in accordance the applicable piping system Division 15 Sections and Division 9 Section 09910 "Painting and Protective Coatings."

2.09 IDENTIFICATION

- A. Provide piping, valve, equipment, and related product identification devices in accordance with Division 10 Section 10952 "Identification, Stenciling, and Tagging."

2.10 HANGERS AND SUPPORTS

- A. Provide hangers and supports as shown on the drawings and in accordance with Division 15 Section "Hangers and Supports for Piping Systems."

2.11 FIRESTOPPING

- A. Voids between sleeves or core-drilled openings and pipe or conduit passing through fire rated assemblies shall be fire stopped to comply with requirements of ASTM E 814.

PART 3 EXECUTION

3.01 PIPED UTILITY DEMOLITION

- A. Refer to Division 1 Section 01731 "Cutting and Patching" and Section 02220 "Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.

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4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. CONTRACTOR shall be responsible for, develop, and comply with the trench safety plan and a confined space entry plan in accordance with Division 2 Section 02260 "Excavation and Support Protection."
- B. CONTRACTOR shall provide a dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades complying with the requirements of Division 2 Section 02240 "Dewatering."
- C. Excavation, trenching and backfilling of trenches for buried utilities shall comply with the requirements of Division 2 Section 02320 "Excavation Backfill for Utilities."
- D. Install all piping systems in accordance with the Drawings, Specifications, reviewed shop drawings and manufacturer's installation instructions. Pipe and fitting materials shall comply with the individual Division 15 piping system sections.
- E. Examine all piping materials prior to installation and replace items that are damaged or otherwise defective.
- F. Thoroughly clean inside of all piping, valves, and accessories, and outside of all materials which will be exposed. Clean before installation and maintain in that condition until accepted by OWNER.
- G. Provide secure temporary caps or plugs over all pipe openings at the end of each day to prevent foreign material from entering the piping systems. Brace pipe to prevent it from floating.
- H. Do not modify structures, equipment, or piping for the purpose of installing piping unless specifically authorized by the ENGINEER.
- I. All piping systems shall be cleaned and tested prior to making connections at structures and to existing pipe systems. Small diameter pipes shall be flushed and large diameter pipes shall have mandrels pulled or other acceptable verification furnished that pipes are clean and no construction debris remains. Temporary blocking and forms used to grout inverts and blockouts shall be removed and manholes and pipes shall be tested before payment will be approved for the last 10 percent of the respective pipe pay estimate items.

3.03 PIPING FLEXIBILITY PROVISIONS

- A. General: Install flexible couplings to facilitate installation of piping, connections to equipment and pumping units, and to permit disassembly of valve, instrumentation components in accordance with approved Shop Drawings.
- B. Flexible Joints at Concrete Backfill or Encasement: Install within 18 inches from the termination of any concrete backfill or encasement.
- C. Flexible Joints at Concrete Structures:
 1. Install 18 inches or less from the face of structure; joint may be flush with face.
 2. Install a second flexible joint, whether shown or not:
 - a. Pipe Diameter 18 Inches and Smaller: Within 18 inches of the first flexible joint.
 - b. Pipe Diameter Larger than 18 Inches: Within one pipe diameter of the first flexible joint.

3.04 DIELECTRIC FITTING APPLICATIONS

- A. Dry Piping Systems: Connect piping of dissimilar metals with the following:
 - 1. NPS 2 and Smaller: Dielectric unions.
 - 2. NPS 2-1/2 to NPS 12: Dielectric flanges or dielectric flange kits.
- B. Wet Piping Systems: Connect piping of dissimilar metals with the following:
 - 1. NPS 2 and Smaller: Dielectric couplings.
 - 2. NPS 2-1/2 to NPS 4: Dielectric nipples.
 - 3. NPS 2-1/2 to NPS 8: Dielectric nipples or dielectric flange kits.
 - 4. NPS 10 and NPS 12: Dielectric flange kits.

3.05 PIPING INSTALLATION

- A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- 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 to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Sleeves are not required for core-drilled holes.
- J. Permanent sleeves are not required for holes formed by removable PE sleeves.
- K. Penetrations: Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - 3. Watertight Penetrations;
 - a. Provide wall pipes with thrust collars.
 - b. Provide taps for stud bolts in flanges set flush with wall face.
 - 4. Non-Watertight Penetrations:
 - a. Pipe sleeves with seep ring or modular mechanical seal.
 - b. Sleeves are not required for core-drilled openings.
 - 5. Existing Walls: Core-drilled openings and use modular mechanical seal.
 - 6. Caulk all sleeves water and air tight. Seal annular space between pipe and sleeve with fire stopping compound.
- L. Verify final equipment locations for roughing-in.

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- M. Refer to equipment specifications in other Sections for roughing-in requirements.
- N. Isolation Valves: Provide piping systems with line size shutoff valves located at risers, at main branch connections to mains for all equipment, and at other locations as indicated and required.
- O. Vent and Drain Valves:
 - 1. Pipe 2-1/2-Inch Diameter and Larger: 3/4-inch vent, 1-inch drain, unless otherwise shown.
 - 2. Pipe 2-inch and Smaller: 1/2-inch vent. 3/4-inch drain, unless otherwise shown.
 - 3. Install vent and drain valves at low points (drains) and high point (vents) of piping systems so that these systems can be entirely drained and vented. Provide line size ball valves for all vents and drains.
- P. Gravity drain systems beneath slabs shall be ductile iron, except for chemical drains, unless shown specifically on Plans. Encase all piping beneath slabs.
- Q. Install cleanouts on sludge piping so that all runs between bends may be accessed and at intervals not exceeding 250 feet on straight runs.
- R. All bolts and fasteners on buried or submerged fittings and valves shall be Type 304 stainless steel.
- S. Provide taps and connections for flushing, testing, and disinfecting pipeline systems.
- T. Provide taps or weld-u-lets with stainless steel ball valves and piping at all high points in the piping systems for addition of air valves.

3.06 PIPING JOINT CONSTRUCTION

- A. General:
 - 1. Join pipe and fittings according to the following requirements and Division 2 Sections specifying piping systems.
 - 2. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - 3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- B. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- C. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- D. Push-on Joints:
 - 1. Comply with the recommendations of the pipe manufacturer relative to gasket installation and other jointing operations.
 - 2. Prepare pipe ends by removing from bell and spigot ends all lumps, blisters, excess coal-tar coatings, oil and grease, then wire brush and wipe clean and dry before laying pipe.
 - 3. Install ring gasket and, when seated, apply thin film of lubricant to inside surface of gasket.
 - 4. Set spigot, applying lubricant as necessary, aligning with bell and contacting gasket.
 - 5. Pipe 6 inches and smaller may be driven with a bar lever on end of pipe.
 - 6. For larger pipe, use only approved ratchet-type jacking tool to pull pipe "home."
- E. Flanged Joints:
 - 1. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical prestressing of flanges, pipe and equipment. Align bolt holes to straddle the

- vertical, horizontal or north-south center line. Do not exceed 3/64-inch per foot of inclination of the flange face from true alignment.
2. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned.
 3. Use bolts, nuts, and washers of the designated material for service conditions. Tighten bolts progressively to prevent unbalance stress. Draw bolts tight to ensure proper seating of gaskets. Use suitable lubricants on bolt threads.
- F. Mechanical Joints:
1. Assemble in accordance with manufacturer's instructions. Remove all foreign matter from pipe ends, gaskets, and fittings before installation.
 2. Wash ends of pipe, gaskets, and fittings with soapy water before assembly.
 3. If effective sealing is not obtained, disassemble joint and clean and reassemble. Over tightening bolts to compensate for poor installation practice will not be permitted.
 4. Mechanical joints shall be suitably restrained to prevent movement.
- G. Mechanical Couplings, Rigid:
1. Install per manufacturer's instructions. Pipe ends shall be clean and smooth.
 2. Space between pipe ends shall be at least 1/4-inch, but not more than 1-inch.
- H. Flexible Couplings and Flanged Coupling Adapters:
1. Install per Drawings and in accordance with manufacturer's instructions at locations to facilitate removal of equipment, valves, and other elements.
 2. All flexible couplings and flanged couplings shall be restrained.
- I. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- J. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.
- K. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- L. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.
- M. Plastic Piping Solvent-Cemented 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. CPVC Piping: Join according to ASTM D 2846.
 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- N. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- O. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- P. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End PE Pipe and Fittings: Use butt fusion.
 2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
- Q. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

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3.07 VALVES AND VALVE BOXES

- A. Prior to installing valves, remove foreign matter from within the valve. Inspect valves in the open and closed position to verify that all parts are in satisfactorily working condition.
- B. Install valves, setting valves plumb, with operators aligned as shown on the Drawings. For buried valves, center valve boxes on valves. Carefully tamp earth around each valve box for a minimum of four feet or to the trench face if less than four feet.

3.08 SECURING AND SUPPORTING

A. Exposed Piping Systems:

- 1. Engineered Hanger and Support System: The CONTRACTOR provide an engineered hanger and support system for the various piping systems in accordance with Division 15 Section 15060 "Hangers and Supports for Piping Systems"; as shown on the Drawings; and as specified herein to maintain the line and grade and prevent the transfer of stress to pumps, equipment and other related work.
 - a. This includes the design of multiple piping supports and trapeze hangers and the selection of appropriate hangers and anchors to the structures, buildings, and facilities. This design shall be accomplished by a professional engineer license in the state where the Project is to be constructed.
- 2. Reaction Anchorage and Blocking: Install suitable reaction blocking, struts, anchors, clamps, joint harness, or other adequate means for preventing movement of pipe caused by unbalanced internal liquid pressure. Pressure can be expected at tees, elbows, Y-branches, and other bends, which are installed in piping subjected to internal hydrostatic heads in excess of 15-feet in exposed piping.

B. Buried Piping Systems:

- 1. Reaction Anchorage and Blocking: Install suitable reaction blocking, struts, anchors, clamps, joint harness, or other adequate means for preventing movement of pipe caused by unbalanced internal liquid pressure. Pressure can be expected at unugged tees, Y-branches and bends deflecting 11-1/4 degrees or more, which are installed in piping subjected to internal hydrostatic heads in excess of 30-feet in buried piping.
- 2. Restrained Joints:
 - a. Unless otherwise indicated on the Drawings, the CONTRACTOR shall provided restrained pipe joints and fittings in accordance with Part 1 Project Requirements.
 - b. All fittings shall be restrained using restrained joint pipe and fittings for a sufficient length to resist the internal hydrostatic pressures.
 - c. Restrained push-on pipe and fittings shall be capable of being deflected after assembly.
 - d. The design for restrained joints, including the length necessary to resist the design thrust and the approval of the fill material and compaction method, shall be performed and sealed by a professional engineer license in the state where the Project is to be constructed.
 - e. The above applies to unsaturated soil conditions. In locations where ground water is encountered, the soil density shall be reduced to its buoyant weight for all backfill below the water table and the coefficient of friction shall be reduced to 0.25.
 - f. Bends and Appurtenances:
 - 1) Provide restrained at all bends.
 - 2) Horizontal changes in pipe direction may be accomplished without the use of direction-changing fittings. Controlled horizontal longitudinal bending using deflected joints may be used and shall not exceed 50 percent of the manufacturer's written recommendations.
 - 3) Vertical changes in pipe direction may be accomplished without the use of directional-changing fittings which require vertical thrust blocking and/or joint restraint. Controlled vertical longitudinal bending shall be

accomplished using deflected joints, resulting in a circular pipe arc where joints do not require restraint. Joint deflections shall not exceed 50 percent of the manufacturer's written recommendations.

- 4) Valves, hydrants, and fittings shall be supported by a concrete block or concrete cradle. The weight of these items shall not be supported by the pipe.

3. Concrete Thrust Blocking:

- a. When specified on the Drawings or with written approval from the ENGINEER, provide concrete thrust blocking between the fitting and solid, undisturbed ground.
- b. In the event that adequate support against undisturbed ground cannot be obtained, install metal harness anchorages consisting of steel rods or bolts across the joint and securely anchored to the pipe and fittings, or other adequate anchorage facilities.

3.09 CORROSION PROTECTION

- A. Provide corrosion protection for all steel clamps, rods, bolts, and other metal accessories used in reaction anchorages or joint harness where subject to submergence or contact with earth or other fill material and not encased in concrete. Apply not less than two coats of coal-tar mastic coating material to clean, dry metal surfaces. Allow first to dry prior to application of second coat.

3.10 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

- B. Connections with Existing Piping:

1. Field verify all dimensions, sizes, configuration and related items on all existing piping to which connections are to be made.
2. Connections between new work and existing piping shall utilize suitable fittings for the conditions encountered.
3. Each connection with an existing pipe shall be made at a time under conditions which will least interfere with service to the OWNER or to customers, and as authorized by the OWNER. Provide notification 48 hours in advance prior to making connections.

- C. Pipe Connections:

1. Piping connections shall be of the type indicated on the Drawings or in the Piping Schedule.
2. Field-welded joints will be permitted only when indicated on the Drawings and will require approval of the ENGINEER.
3. Field-welded joints will only be permitted at locations where the interior coatings can be repaired and inspected.
4. Additional flanged, compression sleeve or grooved end couplings may be added by the CONTRACTOR to facilitate fabrication, handling, transportation and field assembly at no additional cost.

3.11 EQUIPMENT INSTALLATION

- A. Install equipment level and plumb, unless otherwise indicated.
- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

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- C. Install equipment to allow right of way to piping systems installed at required slope.

3.12 PAINTING

- A. Painting of piped systems, valves, specials, hangers and supports, equipment, and components shall be as specified in the various sections and Section 09910 "Painting and Protective Coatings."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.13 IDENTIFICATION

- A. Piping Systems: Install pipe and valve markers, including arrows showing normal direction of flow according to the following:
 - 1. Plastic markers, with application systems. Install on insulation segment if required for hot non-insulated piping.
 - 2. Locate pipe markers on exposed piping according to the following:
 - a. Near each valve and control device.
 - b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
 - c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
 - d. At manholes and similar access points that permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - 3. Exposed wastewater facility piping systems and accessible piping systems within chases shall have product identification bands containing lettering or tags designating the service and flow directional arrows applied in accordance with TCEQ §317.7.(g) and the following table.

Product Identification	Piping Identification Marker
Foul Air Duct	FAD
Calcium Nitrate Solution	CNS
Ferrous Sulfate Solution	FES
Potable Water	PW
Drain	D

- B. Buried Piping System Identification:
 - 1. Buried water piping systems shall have marking tape installed approximately 12 inches above the pipe in accordance with Division 2 Section 02320 "Excavation, Trenching, and Backfilling for Utilities."
 - 2. Install detectable warning tape above non-metallic pipelines.
- C. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment in accordance with Section 10952 "Identification, Stenciling, and Tagging" and the following:
 - 1. Lettering Size: Minimum ¼-inch high for name of unit if viewing distance is less than 24 inches, ½-inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
 - 2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- D. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.14 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "03300 Cast-in-Place Concrete" or Section 03310 "Miscellaneous Cast-In-Place Concrete," which ever is applicable.

3.15 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 15 Section 15060 "Hangers and Supports for Piping Systems" for information on the installation of the engineered hangers and supports for piping systems.

3.16 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 10 Section 10952 "Identification, Stenciling, and Tagging" and Division 16 Section 16075 "Electrical Identification."

3.17 CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

- A. Provide service connections to equipment furnished by others, utilizing equipment shop drawings furnished for indicating type, number and location of connecting points. As part of the work, field adjustments as to the type, number, and location may be required. This is considered part of the Work.
 - 1. Roughing-In: Extend service connections to various items of equipment. Temporarily terminate at proper points as indicated on the shop drawings furnished or as directed.
 - 2. Final Connections: Provide items, such as pipe, fittings, adapters, valves, insulation, and other materials, required to connect equipment from the rough-in locations.
 - 3. Valves: Provide cut-off valve for each service at rough-in locations, except drains.

3.18 CLEANING OF PIPING SYSTEMS

- A. Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the system in service. Provide temporarily connections required for cleaning, purging and circulation.
- B. Install temporary strainers in front of pumps, tanks, solenoid valves, control valves, and other equipment where permanent strainers are not indicated. Keep these strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with line size blow off valve.
- C. Circulate a chemical cleaner in chilled, heating and condensing water systems; and steam and condensing piping systems to remove mill scale, grease, oil, and silt. Circulate for 48-hours, flush system and replace with clean water. Dispose of chemical solution in accordance with local ordinances. The type and quantity of cleaning chemicals shall be as recommended by the supplier for the service.

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3.19 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Lined carbon steel pipe and fittings shall be inspected by the CONTRACTOR after installation to ensure linings are intact in accordance with the piping system section and shall certify to that effect.
 - a. Pipe 24 Inches and Smaller: Engage an inspection organization to video inspect pipe and report findings.
 - 2. Pressure test piping systems in accordance with Division 15 Section 15070 "Field Testing of Plant and Station Piping Systems."
 - 3. Potable water piping systems shall be cleaned, purged, and disinfected in accordance with Section 02675 "Disinfection of Potable Water Piping and Tanks."
 - 4. Additional field-testing shall be as described in the individual piping systems sections of Division 15.
- C. The piping system component(s) will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.20 SUPPLEMENTS

- A. Piping schedule shall be as shown after the 'END OF SECTION.'

END OF SECTION

PIPING SCHEDULE								
SERVICE	SIZE (IN)	EXPOSURE	PIPING MATERIAL	PIPE CLASS	SPECIFICATION SECTION	TEST METHOD P = PNEUMATIC H = HYDROSTATIC	TEST PRESSURE	WORKING PRESSURE
FOUL AIR	36, 48	EXPOSED	FRP	M-45	15892	P	20 INCHES WC	12 INCHES WC
FOUL AIR	30, 42	BURIED	PVC C-905	DR 51	02506	P	20 INCHES WC	12 INCHES WC
CALCIUM NITRATE SOLUTION	≤ 4	BURIED/ EXPOSED	PVC	SCH. 80	15030	H	75 PSIG	10 PSIG
FERROUS SULFATE SOLUTION	≤ 4	BURIED/ EXPOSED	PVC	SCH. 80	15030	H	75 PSIG	10 PSIG
DRAIN, CONDENSATE	≤ 6	BURIED/ EXPOSED	PVC	SCH. 40	15030	H	30 PSIG	15 PSIG
DRAIN, PROCESS	≤ 6	BURIED	PVC D-3034	SDR 35	15030	H	30 PSIG	5 PSIG
POTABLE WATER	≤ 2	BURIED/ EXPOSED	PVC	SCH. 80	15030	H	100 PSIG	60 PSIG

Section 15030

POLYVINYL CHLORIDE (PVC) SOCKET WELDED PIPE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section provides requirements for PVC socket welded pipe for pressure applications in exposed and buried service and includes:

Polyvinyl Chloride (PVC), Schedule 40 and 80, pressure pipe and fittings.

- B. Related Work:

- 1. Refer to Division 15 Section 15015 "Piped Utilities: Basic Materials and Methods" for information regarding submittals; coordination; material delivery, handling, and storage; projection conditions; design requirements; other materials; installation of piping systems; field testing; and related work.
- 2. This Section contains material requirements for pipe, fittings, specials, and appurtenances for PVC socket welded pipe, as well as Part 1- General and Part 3- Execution additional requirements not specified in the above referenced Section.

1.03 REFERENCES

- A. References:

- 1. ASTM International, Inc. (ASTM):
 - a. D1785 – Specification for Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedule 40, 80, and 120
 - b. D2466 – Specification for Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40
 - c. D2467 – Specification for Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 80
 - d. D2564 – Specifications for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
- 2. National Science Foundation (NSF):
 - a. NSF/ANSI 61 – Drinking Water Systems Components – Health Effects

PART 2 PRODUCTS

1.01 PVC PIPE AND FITTINGS, 6-INCH AND SMALLER, PRESSURE

- A. PVC Pipe and Fittings: ASTM D 1785, Schedule 40 and Schedule 80 pipe, with plain ends for solvent-cemented joints conforming to ASTM D 2466, Schedule 40 or ASTM D 2467, Schedule 80, socket-type fittings. Use Schedule 80 for all chemical feed system pipes.
- B. CPVC Pipe and Fittings: ASTM F441, Schedule 40 and Schedule 80 pipe, with plain ends for solvent-cemented joints or threaded ends conforming to ASTM F438, Schedule 40 or ASTM F439, Schedule 80, socket-type or threaded fittings. Use Schedule 80 for all pipes to be threaded.
- C. Solvent Cement: As recommended by the pipe and fitting manufacturer conforming to D2564 for PVC piping systems and ASTM F493 for CPVC piping systems.

PVC SOCKET WELDED PIPE

1.02 JOINING MATERIALS

- A. Refer to Division 2 Section "Piped Utilities - Basic Materials and Methods" for commonly used joining materials.
- B. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

1.03 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Tubular-Sleeve Pipe Couplings:
 - 1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
 - a. Standard: AWWA C219.

PART 3 EXECUTION

1.01 INSTALLATION, CLEANING, AND TESTING

- A. Comply with the requirements of Division 15 Section 15015 "Piping Systems Basic Materials and Methods."
- B. PVC socket welded pipe shall be tested as shown in the piping schedule at the end of Section 15015.

END OF SECTION

Section 15100

VALVES, BASIC REQUIREMENTS AND MISCELLANEOUS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following general-duty valves:
 - 1. Ball Valves, PVC, 6 inches and smaller.
 - 2. Check Valves, PVC, 4 inches and smaller.
 - 3. Angle Type Hose Valve.
 - 4. Angle Pattern Hose Valve.
 - 5. Backflow Preventer, Reduce Pressure.
 - 6. Pressure Reducing Valves.
 - 7. Solenoid Valves.
 - 8. Valve appurtenances.
- B. Related Sections:
 - 1. Refer to Division 15 Section 15015 "Piping Systems, Basic Materials and Methods" for information regarding correlation with piping system submittals; coordination; material delivery, handling, and storage; project conditions; design requirements; other materials; installation of piping systems; field testing; and related work.
- C. Valve and Related Lists: Valve identification is provided on the drawings. The Contractor agrees to prepare his own material and valve takeoff lists as necessary to meet the requirements of the Project.

1.03 DEFINITIONS

- A. Following are standard abbreviations used for valves:
 - 1. CWP: Cold working pressure.
 - 2. EDPM: Ethylene-propylene-diene terpolymer rubber.
 - 3. NRS: Nonrising stem.
 - 4. OS&Y: Outside screw and yoke.
 - 5. PTFE: Polytetrafluoroethylene plastic.
 - 6. SWP: Steam working pressure.
 - 7. WOG: Water, oil and gas (Cold working pressure)
 - 8. TFE: Tetrafluoroethylene plastic.

1.04 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.
- B. Product Certificates: For each type of valve, from manufacturer.
 - 1. Compliance with AWWA, ASTM, and ANSI standards including hydrostatic tests, operational tests and other testing required by the standards.
- C. Operation and Maintenance Data: Provide in accordance with Division 1 Section 01782 "Operation and Maintenance Data."

VALVES, BASIC REQUIREMENTS AND MISCELLANEOUS

- D. Field Quality Control: Provide field testing and performance reports.

1.05 QUALITY ASSURANCE

- A. Obtain all valves of the same style and type, along with the associated manual operators, from a single manufacturer.
- B. NSF Compliance: NSF 61, "Drinking Water Systems Components – Health Effects" for valve materials for potable-water service.
- C. Valve manufacturer shall demonstrate a minimum of five years of experience in similar applications for size of valves furnished. References shall be provided upon request.
- D. Valve supplier shall maintain a complete stock of parts in the state where the Project is constructed or shall indicate that parts will be delivered upon 48-hour after receipt of request.

1.06 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 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.
 - 3. 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

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed in the valve descriptions.

2.02 GENERAL

- A. Valve to include operator, actuator, handwheel, chain wheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, valve boxes, and all accessories and related equipment for a complete operating system. Refer to P&ID Drawings for valves requiring limit switches, electric or pneumatic operators, and related controls.
- B. Comply with the following:
 - 1. Service: Suitable for intended service, with valve pressure and temperature ratings not less than indicated and as required for the system pressures and temperatures.
 - 2. Valve Sizes: Same size as connection to upstream piping, unless otherwise indicated.
 - 3. Valve Ends (Unless otherwise specified):
 - a. Compatible with adjacent piping or equipment connections.
 - b. Bronze Valves: 2-inch and Smaller; threaded or soldered ends depending on application.
 - c. Ferrous valves, 3-inch and Smaller: Threaded ends.
 - d. Ferrous Valves, 3-inch and Larger:
 - 1) Exposed Valves: Flanged ends.

2) Buried Valves: Mechanical joint ends.

- C. Valve Actuators:
 - 1. Operator sized to operate valve for full range of pressures and velocities.
 - 2. Open by turning counterclockwise, clockwise to close, unless otherwise specified.
 - 3. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
 - 4. Gear Drive Operator: For quarter-turn valves 8-inch and larger.
 - 5. Handwheel: For valves other than quarter-turn types.
 - 6. Lever Handle: For quarter-turn valves 6-inch and smaller.
 - 7. Wrench: For valves with square heads. Furnish Owner with one wrench for every 10 valves, for each size square plug head.
- D. Valves in Insulated Piping: Valves shall have 2-inch stem extensions and the following features:
 - 1. Gate Valves: Shall be rising-stem type.
 - 2. Ball Valves: Shall have extended operating handle of non-thermal-conductive material, protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation, and memory stops that are fully adjustable after insulation is applied.
 - 3. Butterfly Valves: Shall have extended necks.
- E. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves and ASME B16.24 for bronze valves.
- F. Valve Grooved Ends: AWWA C606.
- G. Solder Joint: With sockets according to ASME B16.18.
 - 1. Caution: Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.
- H. Threaded: With threads according to ASME B1.20.1.
- I. Valve Bypass and Drain Connections: MSS SP-45.
- J. Factory assemble valve with operator, actuator and accessories.
- K. Fasteners for flanged valves shall be as follows: Comply with pipe joining material requirements of Division 15 Section 15015 "Piping Systems, Basic Materials and Methods."
- L. Obtain all valves of the same type and materials of construction with associated manual operators from a single manufacturer

2.03 MATERIALS

- A. Brass and bronze valve components and accessories shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- B. Approved alloys are of the following ASTM designations:
 - 1. B61, B62, B98 (Alloy No. C65100, C65500, or C66100), B127, B139 (Alloy No. C51000), B584 (Alloy UNS No. C90300 or C94700), B164, and B194.
 - 2. Stainless steel, ANSI Type 316 may be substituted for bronze.

2.04 FACTORY FINISHING

- A. Interior Lining and Coating:
 - 1. Interior ferrous metal surfaces of valve body, stem, actuator and related components shall be epoxy coated in accordance with AWWA C550 "Protective Epoxy Interior Coatings for valves and Hydrants", unless otherwise specified.
 - 2. Epoxy coating material shall be NSF approved for use in potable water.

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3. Either two-part liquid material or heat-activated (fusion) material except only heat-activated material if specified as "fusion" or "fusion bonded" epoxy.
4. Minimum 12-mil dry film thickness except where limited by valve operating tolerances. Epoxy coating shall be spark tested at the valve manufacturer's factory in accordance with AWWA C550 to verify uniform thickness. A certified test report on valve manufacturer's letterhead shall be supplied for each valve furnished.
5. Color to match adjacent piping. Coating application to be accomplished in accordance with Division 9 Section "Painting and Protective Coatings."
6. Safety isolation and lockout valves with handles, handwheels, or chain wheels "Safety Yellow."
7. Exposed valves, other than above, paint handles, handwheels, or chain wheels "Red."

2.05 BALL VALVE

A. PVC/CPVC Ball Valve, 2 inches and Smaller:

1. True union type manufactured to ATSM F 1970 and constructed from PVC Type 1, ASTM D 1784 Cell Classification 12454 or CPVC Type IV, ASTM D 1784 Cell Classification 23447; O-rings shall be EDPM or Viton®; ball seats of PTFE; handles of polypropylene; supplied with solvent-welded or threaded ends; approved for potable water service; rated at 150 psi at 73oF; and shall be full port and block flow in both directions.
2. Manufacturer:
 - a. ASAHI-America.
 - b. Hayward.
 - c. NIBCO.
 - d. Spears.

B. PVC/CPVC Ball Valve, 3 inches through 6 inches:

1. True union type manufactured to ATSM F 1970 and constructed from PVC Type 1, ASTM D 1784 Cell Classification 12454 or CPVC Type IV, ASTM D 1784 Cell Classification 23447; O-rings shall be EDPM; ball seats of PTFE; handles of polypropylene; supplied with solvent-welded connections or flanged ends drilled to ASME B16.4; approved for potable water service; provide a pressure relief hole drilled on the low pressure side of ball; rated at 150 psi at 73 degrees F; and shall be full port and block flow in both directions.
2. Manufacturers:
 - a. ASAHI-America.
 - b. NIBCO.
 - c. Spears.

2.06 CHECK VALVES

A. PVC/CPVC Check Valve, 4 inches and Smaller:

1. True union type manufactured to ATSM F 1970 and constructed from PVC Type 1, ASTM D 1784 Cell Classification 12454 or CPVC Type IV, ASTM D 1784 Cell Classification 23447; O-rings and seals shall be EDPM or Viton®; ball seats of PTFE or standard O-ring type; approved for potable water service; having replaceable valve components; and rated 150-psi at 70 degrees F.
2. Manufacturers:
 - a. ASAHI-America.
 - b. NIBCO.
 - c. Spears.

2.07 GLOBE VALVES

A. Angle Type Hose Valve:

1. Bronze, angle sillcock type body, threaded or soldered inlet as applicable, 1/2-inch or 3/4-inch male hose thread outlet, rated 125-psi CWP.
2. Manufacturer:
 - a. NIBCO
- B. Angle Type Hose Valve:
 1. 3/4-inch NPT female inlet, 3/4-inch male hose thread outlet, heavy rough brass body, rated 125-psi CWP, lockshield bonnet, removable handle, atmospheric vacuum breaker conforming to CSA and IAPMO code.
 2. ACORN Engineering Co.;
 - a. Mounting on structure walls:
 - 1) 8120, bent nose with flange, without vacuum breaker.
 - 2) 8121, bent nose with flange, with vacuum breaker.
 - b. Installation on stand pipes:
 - 1) 8131, pipe and pedestal mounted valve located above 6 inches, straight nose.
 - 2) 8136, pipe and pedestal mounted valve lower than 6 inches, inverted nose.
- C. Angle Pattern Hose Valve, 1-inch through 3-inch:
 1. All-bronze, screwed ends, inside screw, rising stem, TFE disc, outlet of cast brass NHT by NPT, male by male, nipple adapter with hexagonal wrench feature, brass cap with chain, rated 300-psi CWP.
 2. Manufacturer and Product:
 - a. Crane Valve Group; 7TF and 17TF
 - b. James Jones Co.; J-300 Series, angle fire hydrant valve with NPT inlet and NHT outlet.
 - c. ITT Kennedy; Figure 936 angle fire hydrant valve with NPT inlet and NHT outlet.

2.08 MISCELLANEOUS VALVES AND RELATED ITEMS

- A. Reduced Pressure backflow Preventer:
 1. Description: Two check valves, independent relief between the valves; NRS isolation gate valves or ball valves, testing cock in accordance with AWWA C511, rated 175-psi CWP, meet requirements of USC Cross connection Control Laboratory.
 2. Manufacturers:
 - a. Cla-Val Company, Model RP Series
 - b. FEBCO; Model 825Y, 825YD.
 - c. Watts 909-QT RPZ
- B. Gauge Cock:
 1. Description: 1/4-inch bronze body, hexagon end pattern, tee head, male ends, rated 125-psi CWP.
 2. Manufacture and Product: United brass Works; Figure 973.
- C. Corporation Stop:
 1. AWWA C800 type, tapered threaded inlet, except when connecting to tapped fittings which require IPS tapered threads, outlet compression connection or IPS threads to suit connecting pipe, stop 1-inch and smaller rated 100-psi, larger stop rated 80-psi.
 2. Manufacturers:
 - a. Ford Meter Box Co.
 - b. Mueller Co.
- D. Combination Balancing and Shutoff Valve, 2 inches and Smaller for Heating, Chilled, and Cooling Water Service:
 1. Description: Non-lubricated plug valve, cast iron or semi-steel body, wrench lever manual operator, EPT resilient plug facing, adjustable memory stop, threaded ends, rated 175-psi CWP.
 2. Manufacturer:

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- a. DeZurick
- E. Sampling Valve:
 - 1. Description: Insertion type, Type 304 stainless steel bonnet, Type 316 stainless steel piston and stem, threaded end connections, hand crank, rated 600-psig CWP.
 - 2. Manufactures and Products:
 - a. Strahman; SV700.
- F. Shear Gate Valve:
 - 1. Description: Full opening, circular port, standard frame, unless otherwise shown. Cast iron body, ASTM A126, Class B, with integral flange, drilled for mounting; cast iron gate, STM A126, Class B, replaceable wedges, two per gate, with adjustable stop; bronze trim, Type 319 stainless steel bolts and hardware.
 - 2. Manufactures and Products:
 - a. Clow Valve Co.; F3000
- G. Pressure Relief Valves:
 - 1. Wall Type, 4-Inch and 6-Inch:
 - a. Description: Hydrostatic pressure relief for side wall installation in structures and basins. Valve shall be of the 100 offset with offset single pivoted hinge.
 - b. Materials: Body and flap gate, either cast iron, ASTM A126, Class B, or cast bronze, ASTM B584, Alloy 844, with integral ANSI 125-lb flange; bronze trim, neoprene, ASTM D2000, rubber seat either retained by cast iron retainer plate or mounted in a dovetail type groove; hinge arms cast integrally with cover and attached utilizing a stainless steel spring pin.
 - c. Provide mating cast iron wall pipe shall be flange by plain end with internal perforated plate.
 - d. Manufacturers and Products:
 - 1) Clow Valve Co.; F-1494.
 - 2) Waterman; PRB-14.
 - 2. Floor Type, 4-Inch and 6-Inch:
 - a. Description: Hydrostatic pressure relief valve designed for installing in the bottom of concrete structures and basins.
 - b. Materials:
 - 1) Body, cover, and grate shall be either cast iron, ASTM A126, Class B, or cast bronze, ASTM B584, Alloy 844. Provide neoprene, ASTM D2000, seat or seal either bonded to cover mating with bronze seat in body or mounted in groove in cover.
 - 2) Valve shall have either an integral PVC receiver or cast iron receiver, including a water stop, to accept a plastic pipe extension which shall be field cut to desired length. Provide either a cast iron or cast bronze debris screen.
 - c. Manufacturers and Products:
 - 1) Clow Valve Co.; F-1493-T.
 - 2) Waterman; PRF-15.

2.09 SELF-CONTAINED AUTOMATIC VALVES

- A. Pressure-Reducing Valve, 2-1/2 Inches and Smaller.
 - 1. Type: Direct diaphragm operated, spring controlled, bronze body.
 - 2. Size(s) and Rating(s): As shown in valve Schedule.
 - 3. Manufacturers and Products:
 - a. Fisher; Type 75A.
 - b. Mueller; Series H-93 IO.
- B. Pressure-Reducing Valve, 3 inches and Larger:
 - 1. Function:

- a. Automatically reduces a higher inlet pressure to a steady lower downstream pressure, regardless of changing flow rate and/or varying inlet pressure.
 - b. Pilot-operated regulator capable of holding downstream pressure to a pre-determined limit. When downstream pressure exceeds the pressure setting of the control pilot, the main valve and pilot valve close bubble-tight.
 2. Main Valve: Hydraulically operated, single diaphragm-actuated, pilot controlled, globe valve, consisting of:
 - a. Ductile iron, ASTM A536, or cast steel, ASTM A216-WCB, body and bolted cover. All working parts shall be accessible without removal of the valve from the line.
 - b. Disc Retainer and Diaphragm Washer: Cast Iron.
 - c. Trim: Disc guide, seat and cover bearing, bronze or stainless steel.
 - d. Disc: Buna-N rubber.
 - e. Stem, Nut and Spring: Stainless steel.
 - f. End Connections: Flange, 150 ANSI.
 - g. Flows: See Valve Schedule.
 3. Pilot Control System: Direct-acting, adjustable, spring-loaded, normally open, diaphragm valve, designed to permit flow when pressure is less than the spring setting.
 - a. Pilot Control: Bronze, ASTM B62.
 - b. Trim: Type 303 stainless steel.
 - c. Disc: Buna-N rubber.
 - d. Adjustment Ranges: See Valve Schedule.
 4. Manufacturers and Products:
 - a. CLA-VAL; Model 90
 - b. Bermad; Model 720
 - c. GA Industries;
 - C. Solenoid Valve, 2-Inch and Smaller:
 1. Type: Two-way internal pilot operated diaphragm type, brass body, resilient seat suitable for air or water, solenoid coil molded epoxy, NEMA Class A, 120 volts ac, 60-Hz, unless otherwise indicated. Solenoid enclosure NEMA 250, Type 4, unless otherwise indicated.
 2. Sizes and normal position (OPEN or CLOSED) as indicated.
 3. Minimum operating pressure differential no greater than 5-psig, maximum operating pressure differential not less than 125-psig.
 4. Manufacturers:
 - a. ASCO
 - b. Skinner
 - D. Ball Valves, Electric Operated, 2-Inch and Smaller:
 1. Type: Continuous duty rated true union ball valve with manual override and NEMA 4X nonmetallic housing over actuator, closure time 6 seconds for 90o cycle.
 2. Materials.
 - a. Body: PVC or CPVC to match piping, minimum pressure rating 230-psi.
 - b. Seals: EDPM or Vitron as applicable for intended service.
 - c. Motor: Heavy duty gear train, reversible motor with thermal overload switch, 120-volt, 60-Hz, with position indicator.
 3. Manufactures and Products:
 - a. GF Model 346 ball valve with Type EA20 actuator and Type 126 bracket.
- 2.10 APPURTANCES
- A. Manual Operators:
 1. Provide manual operators on valves, except those which are equipped with power actuated operators or designed for automatic operation.
 - a. Operator force not to exceed 40 pounds under any operating conditions, including initial breakaway. Gear reduction operator when force exceeds 40 pounds.
 - b. Operator self-locking or equipped with self-locking devices.
 - c. Position indicator on quarter-turn valves

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- d. Worm and gear operators one-piece design worm-gears of gear bronze material. Worm hardened alloy steel with thread ground and polished. Traveling nut type operators threaded steel reach rods with internally bronze or ductile iron nut.
 2. Exposed Operator:
 - a. Galvanized and painted handwheels.
 - b. Lever operators allowed on valves 6 inches and smaller.
 - c. Cranks on gear operators.
 - d. Chain wheel operator with tie backs, extension stem, floor stands, and other accessories to permit operation from normal operation level.
 - e. Valve handles to take a padlock and handwheels a chain and padlock.
 - f. Handwheels to comply with requirements of AWWA C500, Section 3.15 "Wrench Nuts and Handwheels."
 3. Buried Valves: Wrench Nuts:
 - a. Buried Valves: 2-1/2-Inch and Smaller: Provide cross handle for operation by a forked key.
 - b. Buried Valves, 3-Inch and Larger: Provide wrench nuts on buried valves, on valves which are to be operated through floor boxes and where shown on Drawings.
 - 1) Comply with requirements of AWWA C500, Section 3.15 "Wrench Nuts and Handwheels."
 - 2) Furnish no less than two operating keys for operation of wrench nut operating valves.
 - c. Provide concrete pad, 2-foot square by 6-inch thick concrete around valve box at ground surface.
 4. Design buried service valves for quarter-turn valves to withstand 450 foot-pounds of input torque at the fully open or FULLY CLOSED positions, grease packed and gasketed to withstand a submersion in water to 10-psi.
 5. Buried valves shall have a valve box. Valve box and bonnet shall be cast iron. All components of shaft extensions shall be Type 316 stainless steel including nut shaft, shaft housing and guides.
 6. Extension stem diameter shall be 1-inch or diameter of valve shaft, whichever is greater.
 7. Stem guides made of cast iron with bronze bushings with adjustable offset. Provide stem guides at 5-foot intervals.
- B. Chain Wheel and Guide: Handwheel direct mounted, with galvanized or cadmium-plated chain.
- C. Operating Stands:
 1. Provide fabricated steel or cast iron operating stands in locations shown on the Drawings.
 2. Support handwheel or operator approximately 36 inches above finish floor.
 3. Handwheel diameter will not be less than 8 inches.
 4. Provide sleeve made for opening in floor beneath each operating stand.
 5. Provide suitable thrust bearing in each operating stand to carry weight of extension stem.
- D. Valve Boxes:
 1. Cast iron, extension sleeve type, suitable for depth of cover required by Drawings.
 2. Not less than 5 inches in diameter and minimum thickness at any point of 3/16-inch; provide valve boxes with suitable cast iron bonnets, bases and covers.
 3. Provide covers; cast thereon an appropriate name designating service for which valve is used.
 4. When located in traffic areas, designed for H-20 loadings.
 5. Set valves and valve boxes plumb; place each valve box directly over valve it serves, with top of box flush with finished grade.
 6. As shown on Drawings, provide concrete pad around valve surface box at ground surface.
- E. Extension Stem:
 1. Provide extension stem when depth of valve is more than 3-feet below finish grade.

2. Provide extension stem with wrench nut locating the wrench nut 6 inches below ground surface and/or box cover.
 3. Extension stem shall locate wrench nut in floor box.
- F. Floor Box and Stem: Plain type for support of non-rising type stem, complete with stem, operating nut, and stem guide brackets. Provide stainless steel guides with adjustable offset. Spaced such that stem L/R ratio does not exceed 200. Anchor bolts to be Type 316 stainless steel.
- G. Torque Tube: Where operator for quarter-turn valve is located on floor stand, furnish extension stem torque tube of a type properly sized for maximum torque capacity of valve.
- H. Identification: Provide valve identification tags in accordance with Division 10 Section 10952 "Identification, Stenciling, and Tagging" and as specified in the various Valve Schedules and as shown on the Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. 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.
- C. Operate valves in positions from fully open to fully close. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. 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.
- F. Do not attempt to repair defective valves; replace with new valves.

3.02 INSTALLATION

- A. General:
1. Install valves, floorstands, valve boxes, and appurtenances in accordance with the Drawings and manufacturers instructions.
 2. Install valves and operators or actuators to provide for ease of access and operation.
 3. Install buried valve
- B. Flanged Ends:
1. Bolt holes shall straddle vertical centerline of pipe.
 2. Clean flange faces, insert gasket and bolts, and tighten nuts progressively and uniformly.
- C. Threaded Ends:
1. Clean threads by wire brushing or swabbing.
 2. Apply joint compound.
- D. Valve Installation:
1. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
 3. Locate valves for easy access and provide separate support where necessary. Provide access doors in finished walls and plaster ceilings for valve access.

VALVES, BASIC REQUIREMENTS AND MISCELLANEOUS

4. Install valves in horizontal piping with stem at or above center of pipe.
 - a. Butterfly valves will be installed with stem horizontal to allow support for the disc and the cleaning action of the disc.
 - b. Unless otherwise noted, install operating stem vertical in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above finished floor.
 - c. Unless otherwise noted, install operating stem horizontal in horizontal runs of pipe having centerline elevation between 4 feet 6 inches and 7 feet above finish floor.
5. Install valves in position to allow full stem movement.
6. Install check valves for proper direction of flow and as follows:
 - a. Swing Check Valves: In horizontal position with hinge pin level.
 - b. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
 - c. Lift Check Valves: With stem upright and plumb.
7. Butterfly valves shall be installed with stems horizontal.
8. If a plug valve seat position is not shown, locate as follows:
 - a. Horizontal low: The flow shall produce an "unseating" pressure; the plug shall open into the top half of valve.
 - b. Vertical Flow: Install seat in the highest portion of the valve.
9. Install line size ball valve and union upstream of each solenoid valve, in-line flow switch, or other in-line electrical device, excluding magnetic flowmeters for isolation during maintenance.
10. Provide union or flanged connection within two feet of each threaded end valve unless valve can be otherwise easily removed from piping.
11. Install safety isolation valves on compressed air lines which have stored energy in accordance with latest OSHA requirements.

E. Valve Operators:

1. Manual Operators:
 - a. Provide manual operators on valves, except those which are equipped with power actuated operators or designed for automatic operation.
 - b. Unless otherwise specified in the various valve sections, provide handwheel or lever operators for valves, 6-inch and smaller, and gear operators for valves, 8-inch and larger.
2. Buried Service:
 - a. 2-1/2-inch and smaller:
 - b. 3-inch and Larger (not installed in Valve Vault):
 - 1) Provide stainless steel shaft extension and wrench nut. Minimum extension stem diameter shall be 1-inch or diameter of valve shaft, whichever is larger.
 - 2) Provide valve box, bonnet and cover.
 - c. Wrench nut, handwheel and gear operator shall comply with the requirements of applicable AWWA Standards.
 - d. As shown on the Drawings, buried Valves, 8-inch and larger, shall rest on concrete pad. Pad shall extend full width of trench, from back-to-back of hub or flange.
3. Above Ground Service:
 - a. 3-inch and Larger: gear operators all valves 8-inch and larger, unless otherwise noted.
 - b. Chain Wheel Operators: Install chain wheel operators on valves 4-inch and larger and more than 84 inches above floor, unless otherwise noted. Extend chains to 60 inches above finished floor elevation. Where chains hang in normally travel areas, use appropriate "L" type tie-back anchors.
4. Electric and pneumatic operators and actuators shall comply with the requirements of the applicable Division 15 operator section.

3.03 FIELD QUALITY CONTROL

A. Perform Tests and Inspections:

1. Valve may be either tested while testing pipelines, or as a separate step.
 2. Test that valve opens and closes smoothly with operating pressure on one side and atmospheric pressure on the other, in both directions for two-way valve and applications.
 3. Count and record the number of turns to open and close valve; account for any discrepancies with manufacturer's data.
 4. Set, verify, and record set pressures for all relief and regulating valves.
 5. Automatic valves to be tested in conjunction with control system testing and as specified under Manufacturer's services.
- B. Prepare test and inspection reports.

3.04 VALVE SCHEDULE

Valve information is not summarized in a schedule, refer to valve identification information on the Drawings.

END OF SECTION

Section 15166

TANKS, POLYETHYLENE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

Section Includes:

- A. High-Density Polyethylene (HDPE) double wall, bulk storage tank(s).
- B. Tank accessories.

1.03 REFERENCES

- A. References: Following is a list of standards, which might be referenced in this Section:
 - 1. ASTM International (ASTM):
 - a. D638 – Tensile Properties of Plastics
 - b. D648 – Heat Distortion Temperature
 - c. D790 – Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
 - d. D883 – Standard Terminology Relating to Plastics
 - e. D1505 – Density by Density-Gradient Technique
 - f. D1525 – Test Method for Vicat Softening Temperature of Plastics
 - g. D1693 – Test Method for Environmental Stress-Cracking of Ethylene Plastics
 - h. D1921 – Particle Size (Sieve Analysis) of Plastic Materials
 - i. D1998 – Standard Specification for Polyethylene Upright Storage Tanks
 - j. D2765 – Degree of Cross-linking in Ethylene Plastics as Determined by Solvent Extraction
 - k. D2837 – Standard Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
 - l. D3892 – Practice for Packaging/Packing of Plastics
 - m. F412 – Definitions of Terms Relating to Plastic Piping
 - 2. Association of Rotational Molders (ARM):
Low Temperature Impact Resistance (Falling Dart Test Procedure)
 - 3. National Science Foundation (NSF): NSF 61, Drinking Water Components – Health Effects

1.04 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. All equipment specified herein shall be specifically designed for this service and the environment encountered in this installation.
 - 2. All equipment, supports, anchors and fasteners shall be of adequate strength to withstand loads associated with filling, turbulence, thrusts from liquid movement, thermal expansion and contraction and other loads encountered under normal operating conditions.
 - 3. Loading Conditions: Tank shall meet the following design criteria:
 - a. Wind load limit when anchored: 100 mph.
 - b. Concentrated top load limit: 250 lbs on a 16 square-inch area.
 - c. Static head of contents in accordance to the specific gravity of the chemicals stored.

1.05 SUBMITTALS

- A. Product Data: Provide construction details, material descriptions, dimensions of individual components and profiles, finishes for rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For each chemical storage tank, provide general arrangement plan, elevations, sections, details, and attachments to other work.
 - 1. Details of any revisions to adapt the piping, structure, instrumentation, electrical, or other portions of the work to the tanks proposed.
 - 2. Complete system drawings showing orientation of the tank openings, nozzles, supports for piping and appurtenances, mixer support stand or framing, wall thickness, and anchoring devices and locations.
- C. Samples: A sample of each of the polyethylene tanks shall be furnished to the ENGINEER for review prior to shipment.
- D. Operation and Maintenance Data.
- E. Information Submittals:
 - 1. Manufacturer's Certification of Compliance.
 - 2. Special shipping, storage and protection, and handling instructions.
 - 3. Manufacturer's instructions for installation.
 - 4. Manufacturer's Certificate of Proper Installation.
 - 5. Qualifications: Manufacturer and manufacturer's representative.
 - 6. Warranty: Sample of special warranty.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. All equipment shall be the product of a manufacturer having at least ten (10) U.S. installations of the type being proposed, each with a minimum of 5 years of satisfactory service.
 - 2. A list of similar installations shall be furnished with the shop drawing submittal, including names and telephone numbers of contacts.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- C. Source Limitations: Equipment units of each type specified in this section shall be supplied by a single manufacturer.
- 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.

1.07 DELIVERY, STORAGE, AND HANDLING

Deliver, handle and store pumping system components in accordance with manufacturer's written instructions and the requirements of Division 1 Section 01600 "Product Requirements."

1.08 PROJECT CONDITIONS

- A. System Arrangement:
 - 1. The storage tanks, sizes, materials, and arrangements described in this Specification section are typically based on recommendations by equipment manufacturers and shall be considered minimum limits of acceptability. The equipment MANUFACTURER shall be responsible for design, arrangement, and performance of all equipment supplied under this section.
 - 2. Modifications to structural design due to a manufacturer's varying space requirements, foundation requirements, floor slope requirements, or dimension changes to fit

- manufacturer specific requirements shall be coordinated by CONTRACTOR and included in the Bid.
3. The CONTRACTOR shall be responsible for any modifications to the piping, electrical, structural, and mechanical layouts to accommodate, as well reimbursement to OWNER for additional charges by ENGINEER for additional work required to accomplish changes.
- B. Environmental Conditions:
1. All equipment including controls and drives specified herein shall be specifically designed for this service and the environment encountered in this installation.
 2. When installed in wastewater treatment areas, the environment will be moist, and corrosive, exhibiting hydrogen sulfide and other corrosive gases encountered in municipal wastewater treatment plants.
 3. Designed and capable of operation at ambient temperatures of 0 to 110 degrees F.
- C. NSF Certified: All surfaces and materials in contact with water or in contact with a chemical being added to water that is being treated for potable water use and conveyance, shall comply with the requirements of the Safe Drinking Water Act and shall conform to NSF-61. Product shall bear the mark or seal of an accredited testing laboratory.

1.09 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail(s) in materials or workmanship within specified warranty period.
1. Warranty Period: Two (2) years from date of Substantial Completion.
 2. Cost for the removal, shipment, repair and installation by CONTRACTOR shall be included in warranty, as well as correction of defective work.
 3. Provide guarantee the tank material of construction is suitable for the chemical to be stored in the tank.

PART 2 PRODUCTS

1.01 MANUFACTURERS

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- A. Assmann Corporation of America.
- B. Poly Processing Company.
- C. Snyder Industries, Inc.

1.02 MATERIALS

The material used shall be virgin polyethylene resin.

- A. Tanks shall be manufactured from cross-linked polyethylene resin as manufactured by ExxonMobil Chemical, or resin of equivalent physical and chemical properties.
- B. All tanks shall contain a suitable ultraviolet stabilizer, minimum 0.3 percent (0.3 %) 2-hydroxy-4-n-Octoxy-benzophenone or equivalent. The stabilizer shall be compounded into the polyethylene.
- C. The resins shall be pigmented as required to achieve the color selected by the OWNER. Unless otherwise specified finish color shall be white. Pigment loading shall be limited to industry standard to avoid degradation of the material. No fillers shall be added to the resin.
- D. Finished surface shall be free from visual defects such as foreign inclusions, air bubbles, pinholes, and craters.
- E. Material property requirements are listed in Table 1.

TABLE 1 Material Properties			
Property	Units	ASTM	Cross-linked High-Density Polyethylene
Density (resin)	g/cc	D1505	0.938 – 0.945
Tensile Yield Stress	psi	D638	3,000
Elongation at Break	%	D638	>300%
ESCR (100% Igepal, Cond. A, F50)	Hours	D1693	>1,000
ESCR (10% Igepal, Cond. A, F50)	Hours	D1693	>145
Vicat Softening Temperature	Deg. F	D1525	250
Flexural Modulus	psi	D790	100,000
Impact ARM ¼-inch Thickness	ft-lbs	ARM	3,000
UV Stabilized	--	--	Yes
FDA Grade Resin	--	--	Yes

1.03 TANK DETAILS

- A. Primary tank shall be integrally molded as one piece, including floor and top, and have a minimum hydrostatic design stress of 500 psi. The secondary containment tank, outer tank, shall be integrally molded as one piece, including floor.
- B. Fabricated nozzles, gaskets, bolts, and other fitting accessories shall be chemically compatible with the intended contents of the tank.
- C. Fittings shall be PVC. Bolts and hardware shall be Type 316 stainless steel unless otherwise shown. Bolts and hardware shall be 316 SST.
- D. Gasket material shall be EPDM or other suitable material for chemical stored.
- E. A vent shall be provided to vent pressure buildup or collapse of the tank during filling and draining. Vent shall be 3-inch 180-degree type with 16-mesh screen. Screen shall be Type 316 stainless steel.
- F. Piping supports shall be provided on the tank for the 2" fill pipe and the 1" feed pipe.
- G. Flange adapters shall have 150-lb ANSI drilled bolt patterns.
- H. The tanks shall have the following connections:
 - 1. 24" top manway provided with gasketed cover.
 - 2. 2" inlet connection on tank dome with integral pipe supports.
 - 3. Two flange connections on the tank dome shall be provided for mounting two ultrasonic level indicators, one primary unit and one redundant unit.
 - 4. Outlet connection with 2" dip tube and foot valve compatible with material stored, all with 316 SS bolts and EPDM gaskets. Integral pipe supports for a 1" pipe routed down the side of the tank.
- I. Leak Detection System
 - 1. Leak detection controls are to be mounted in a NEMA 4X plastic enclosure with power on/off switch, power light, leak detection light, alarm silence push button, control relay, alarm horn with sound output at 2-feet to be 68-90 dB. System shall be capable of sending a signal to the SCADA system.

2. Leak detection sensor shall be a capacitive proximity switch of ABS plastic, or other suitable material for chemical stored, with a NEMA 4X rating and be rated for the conditions specified herein.

1.04 ACCESSORIES

- A. Equipment Identification Plates: An identification plate shall be securely mounted on the equipment in a readily visible location. The nameplate shall include the following information:
 1. Serial number.
 2. Customer.
 3. Customer purchase order number.
 4. Tank model.
 5. Tank capacity.
 6. Design pressure.
 7. Service temperature.
 8. Product with specific gravity and concentration.
 9. Resin information.
 10. Date of fabrication.
 11. Tank tag number.
- B. Tank Support Stand: A 4 foot tall stand of open construction, mild steel with epoxy coating suitable for short term wastewater immersion shall be provided for installation under each tank to provide flow through of water during anticipated flooding events. The restraint system for attaching the stand to an existing concrete slab and for attaching the tank to the support stand shall be designed for seismic zone 4 and a wind loading of 120 MPH. The design shall be confirmed by the stamp of a Professional Engineer as meeting these requirements.
- C. Lifting Lugs: Individual equipment weighing over 100 pounds shall be provided with lifting lugs.
- D. Insulation: Where scheduled in Part 1.4, insulation shall be provided on the tank's exterior sides and tops with insulation which meets the requirements below:
 1. Insulation shall be 2-inches thick and consist of polyurethane foam and shall have an "R" factor of approximately 12. "R" factor shall be calculated exclusive of the tank wall values.
 2. Insulation shall be of uniform density and thickness in order to avoid areas of incalculable heat loss. All nozzle and fittings shall have insulations replaced around lay-up areas.
 3. Insulation shall be protected by a minimum of 2-coats of mastic.
 4. Insulated tanks shall have a minimum of one external horizontal expansion joint for every 8-feet of tank height in order to accommodate thermal expansion.
 5. Insulated tanks shall be furnished with an exterior color as selected by the OWNER.
- E. Heating Kits: Where scheduled in Part 1.4, tanks shall be provided with heating kits which meet the following requirements below:
 1. Kits shall consist of adhesive backed thin carbon strip heat tracing elements embedded in clear polyester filter which are wrapped around the tank.
 2. Tank heating kits shall be designed for use with the specified insulation above, a temperature of 75oF, and a wind speed of 100 mph.
 3. Tank heating kits shall have a NEMA 4X control box to control the operation of the heating system.
- F. Ladders: Where scheduled, tanks shall be provided with ladders which meet the requirements below:

Ladder assemblies shall be built to the most recent OSHA guidelines from a fiberglass reinforced plastic. A safety cage shall be provided when required by OSHA. Dimensions of ladders and safety cage shall meet the requirements of OSHA.
- G. Ultrasonic level indication/transmission system shall be provided with control display device housed in a Fiberglass polycarbonate NEMA 4X enclosure. The system shall include both

audible and visual alarms for high and low level indication. The system is 110/ VAC with a total current draw of .10 Amps. The display is 1" tall -8 characters. Tank transducer shall have a range as required for the conditions shown on the drawings and shall be constructed of PVDF faced ceramic.

- H. Reverse Float Level Indicator compatible with the chemical service conditions shall be provided. Location of float shall allow for easy viewing from the fill station. Support system shall be provided that eliminates side wall penetrations.

PART 3 EXECUTION

1.01 GENERAL

Install and adjust equipment in accordance with the Drawings, approved shop drawings, and the manufacturer's instructions. Do not operate the equipment until the installation is approved by the manufacturer's representative.

1.02 INSTALLATION

- A. Upon delivery, the tanks and accessories shall be checked closely for damage. Any tanks or accessories found to be damaged will not be accepted. The tanks and accessories shall be handled with care to prevent inadvertent damage during installation.
- B. Install equipment in complete accordance with the manufacturer's instructions.
- C. The tank foundations must provide smooth and continuous full bottom support (maximum deviation 1/8-inch per 4-feet in any direction).
- D. Touch up scratches and scrapes in painted surfaces in accordance with Division 9 Section "Protective Coatings."
- E. Check installation prior to start-up for conformance to manufacturer's instructions. Adjust or modify equipment to ensure proper operation.

1.03 FIELD QUALITY CONTROL

- B. Hydrostatic Test: After the tanks have been installed and before piping connections are made and equipment attached, block and fill tanks with clear water for a period of at least four (4) hours. Any leaks shall be repaired and retested until all leaks have been detected and repaired to the satisfaction of the ENGINEER. The manufacturer's representative shall conduct performance test on the equipment to certify compliance with the performance requirements.

1.04 MANUFACTURERS' CERTIFICATES

- C. Provide equipment manufacturer's Certificate of Installation stating that the equipment is installed per the manufacturer's recommendations and in accordance with the Drawings and Specifications.
- D. Provide equipment manufacturer's Certificate of Performance stating that the equipment meets or exceeds the performance requirements as defined hereinbefore.

1.05 CLEANING

- E. After installation of completed and piping connections are made, clean tank and nozzle with a mild soap solution and rinse with 180 degree F water.

1.06 SUPPLEMENTS

- F. Section includes the Tank Schedule attached after the END OF SECTION.

END OF SECTION

TANK SCHEDULE			
Name of Tank	<i>Ferrous Sulfate Tank</i>	<i>Ferrous Sulfate Tank</i>	<i>Calcium Nitrate Tank</i>
Tank Number(s)	<i>T-001</i>	<i>T-002</i>	<i>T-003</i>
Chemical	<i>Ferrous Sulfate, 5%</i>	<i>Ferrous Sulfate, 5%</i>	<i>Calcium Nitrate, 60%</i>
Tank Construction	<i>Double Wall</i>	<i>Double Wall</i>	<i>Double Wall</i>
Capacity, (gallons)	<i>4,000</i>	<i>4,000</i>	<i>4,000</i>
Installation	<i>Vertical</i>	<i>Vertical</i>	<i>Vertical</i>
Inner Tank Diameter	<i>7'-4"</i>	<i>7'-4"</i>	<i>7'-4"</i>
Outer Tank Diameter	<i>8'-0"</i>	<i>8'-0"</i>	<i>8'-0"</i>
Overall Height	<i>14'-9"</i>	<i>14'-9"</i>	<i>14'-9"</i>
Support	<i>Epoxy Coated Steel Stand, height: 4'-0"</i>	<i>Epoxy Coated Steel Stand, height: 4'-0"</i>	<i>Epoxy Coated Steel Stand, height: 4'-0"</i>
Type of Bottom Head	<i>Flat</i>	<i>Flat</i>	<i>Flat</i>
Type of Top Head	<i>Dome</i>	<i>Dome</i>	<i>Dome</i>
Ladder Required	<i>No</i>	<i>No</i>	<i>No</i>
Exterior Loading, (psf)			
Personnel	<i>None</i>	<i>None</i>	<i>None</i>
Platform	<i>None</i>	<i>None</i>	<i>None</i>
Mixer	<i>None</i>	<i>None</i>	<i>None</i>
Pipe Supports	<i>As Required</i>	<i>As Required</i>	<i>As Required</i>
Nozzle Schedule			
Top Manway	<i>24"</i>	<i>24"</i>	<i>24"</i>
Side Manway	<i>None</i>	<i>None</i>	<i>None</i>
Outlet	<i>2"</i>	<i>2"</i>	<i>2"</i>
Fill	<i>2"</i>	<i>2"</i>	<i>2"</i>
Overflow	<i>None</i>	<i>None</i>	<i>None</i>
Return	<i>NA</i>	<i>NA</i>	<i>NA</i>
Site Glass Connections	<i>None</i>	<i>None</i>	<i>None</i>
Vent	<i>3"</i>	<i>3"</i>	<i>3"</i>
Other	<i>1. Dome fitting for sonic level indicator/transmitter 2. Dome fitting for redundant sonic level indicator/transmitter</i>	<i>1. Dome fitting for sonic level indicator/transmitter 2. Dome fitting for redundant sonic level indicator/transmitter</i>	<i>1. Dome fitting for sonic level indicator/transmitter 2. Dome fitting for redundant sonic level indicator/transmitter</i>

Section 15892

ODOR CONTROL, FIBERGLASS DUCT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. FRP ducts, fittings, dampers, expansion joints, hangers and supports.

1.03 REFERENCES

- A. American Water Works Association (AWWA):
 - 1. M-45 American Water Works Manual of Water Supply Practices "Fiberglass Pipe Design"
- B. ASTM International, Inc. (ASTM):
 - 1. C582 Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment
 - 2. D2310 Classification for Machine-Made "Fiberglass" Pipe
 - 3. D2992 Practice for Obtaining Hydrostatic Design Basis for Fiberglass Pipe and Fittings
 - 4. D3299 Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Chemical-Resistant Tanks
 - 5. D3567 Practice for Determining Dimensions of "Fiberglass" (Glass-Fiber Reinforced-Thermosetting-Resin) Pipe and Fittings
 - 6. D3982 Specification for Contact Molded "Fiberglass" Duct and Hoods
 - 7. D4021 Glass Fiber-Reinforced Polyester Underground Petroleum Storage Tanks
 - 8. D4097 Contact-Molded Glass-Fiber-Reinforced Thermoset Resing Chemical-Resistant Tanks
- C. Voluntary Product Standard, U.S. Department of Commerce (VPS):
 - 1. PS 15-69 "Custom Contact-Molded Reinforced Polyester Chemical-Resistant Process Equipment" (Replaced with ASTM D2996, D3299, D4021 and D4097)

1.04 SUBMITTALS

- A. Shop Drawings: For Duct System. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail duct assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Provide a detailed layout of the duct support system showing locations and type of hangers and supports to be provided.
 - 3. Provide field butt and wrap joint connection details on shop drawings.
 - 4. Provide copy of manufacturer's certified ASTM D2992 HBD testing results.
- B. Qualification Data: For qualified manufacturer.
- C. Material Certificates: For each type of material or product, from manufacturer.

ODOR CONTROL, FIBERGLASS DUCT

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall demonstrate a minimum of five years of experience in similar applications for size of odor control duct system furnished. References shall be provided upon request.
- B. Single Manufacturer: Duct systems shall be the product of a single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Belco Manufacturing.
 - 2. Bondstrand
 - 3. Ershigs
 - 4. Fibercast

2.02 DUCT AND FITTINGS

- A. Design Conditions:
 - 1. Duct system shall be designed for a working pressure range of 12-inches WC positive and minus 2-inches WC negative pressure.
 - 2. Buried duct shall be designed per AWWA M-45 and shall be rated for H-20 loading.
 - 3. Minimum wall thickness for FRP duct shall conform to the following:
 - a. Wall thickness for internal positive pressure determined by ASTM D2310 using duct manufacturers certified ASTM D2992 Hydrostatic Design Basis (HDB) test results. Provide copy of HDB testing with the wall thickness calculations.
 - b. Comply with the minimum thickness listed in the table below.

Duct Inside Diameter (inches)	Wall Thickness (inches)
3 - 16	0.1875
18 - 24	0.250
30 - 36	0.250

- c. FRP ductwork shall be designed and fabricated for odor control service to carry warm, moisture-laden air with hydrogen sulfide, mercaptans and other organic and inorganic compounds typically associated with wastewater treatment.
 - d. Resin:
 - 4. Resin Type: Premium corrosion resistant and fire retardant brominated bisphenol-A vinyl ester. Resin shall not contain pigments, dyes, colorants or fillers.
 - 5. Flame Spread Rating: Class 1 flame spread rating (25 or less).
 - 6. Thixotropic agents may be added to control resin viscosity per resin manufacturer's instructions.
 - 7. Acceptable resins with 3 percent antimony trioxide are:
 - a. AOC Vipel KO22.
 - b. Ashland Chemical Hetron FR922.
 - c. Interplastics CoRezyn 8442.
- B. Reinforcement:
 - 1. Surfacing Veil: Class C with a silane finish and a styrene soluble binder.
 - 2. Chopped Strand Mat: Type E glass, minimum 1-1/2 ounces per square foot with a silane finish and a styrene soluble binder.

3. Continuous Roving, Chopper Gun Spray-up: Type E glass.
 4. Woven Roving: Type E glass, minimum 24 ounces per square yard with a five by four weave.
 5. Continuous Roving, Filament Wound: Type E glass with a silane finish.
- C. Construction:
1. Ductwork, 10-Inch and Smaller: Hand lay-up or filament wound construction.
 2. Ductwork, 12-Inch and Larger: Filament wound.
 3. Not Acceptable: Cast duct with no reinforced internal corrosion barrier or press molded fittings.
 4. Allowable Deflection: 1/2-inch maximum between supports.
 5. Safety Factor: 10 to 1 for pressure and 5 to 1 for vacuum.
 6. Out-of-Roundness: Limited to 1.0% of diameter.
 7. Length, Flanged Duct Sections: Maximum variance \pm 1/2-inch at 70oF.
 8. Un-flanged Ductwork: Square on ends in relation to center axis within \pm 1/8-inch, 24-inch diameter and smaller; \pm 3/16-inch, diameters greater than 24-inch.
- D. Laminates:
1. Layers: Resin-rich inner surface, an interior corrosion barrier, an interior structural layer, and an exterior corrosion layer and UV resistant coating.
 2. Inner Surface: Nominal 10-mils thick consisting of a single ply Class C glass surfacing veil embedded in a resin-rich surface. Resin content shall be 90%.
 3. Interior Layer: Nominal 90-mils thick consisting of at least two layers of chopped strand mat. Resin content shall be 75%.
 4. Structural Layer: Type E glass meeting minimum wall thickness specified in the previous table. Total wall thickness includes the inner surface layer.
 - a. Contact molded structural layer shall include alternate layers of chopped strand mat and woven roving.
 - b. A layer of chopped strand mat or spray chop shall precede filament wound structural layer. The structural layer shall consist of a minimum of two complete cross hatched layers of continuous filaments applied in a helix angle of 55 to 65 degrees for above-ground ductwork and 75 degrees for buried ductwork.
 5. Exterior Corrosion Layer: Single Class A or C glass veil shall be applied to all ductwork.
 6. Exterior UV Resistant Coating: Factory applied paraffinated gel coat with UV inhibitors. ENGINEER shall determine pigmentation.
- E. Fittings:
1. General Construction:
 - a. Construction: Hand-lay up construction fabricated from the same resin and shall have the same strength as the ductwork.
 - b. Internal Diameter: Equal to adjacent duct.
 - c. Angle Tolerance: \pm 1 degree, 24-inch and smaller, and \pm 1/2 degree, larger than 24-inch.
 2. Elbows:
 - a. Centerline radius shall be 1-1/2 times diameter.
 - b. Elbows, 24-Inch and Smaller: Smooth radius.
 - c. Elbows, 30-Inch and Larger: Mitered, provide a minimum two mitered joints (3-piece) for elbows greater than 45 degrees.
 3. Flanges:
 - a. Provide flanged connections to flexible connectors, expansion joints, vessels, demisters, fans, silencers, and at other locations shown on the Drawings.
 - b. Hand lay-up construction, with dimensions in accordance with VPS PS 15-69 and as shown on the Drawings.
 - c. Drilled in accordance with VPS PS 15-69, Table 2, having backs flat face permitting washer seating fully on bolt face and flange back.
 - d. Flange Face Tolerance:
 - 1) Perpendicular to duct axis with 1/2 degree.

- 2) Flat within $\pm 1/32$ -inch, 18-inch diameter and smaller.
- 3) Flat within $\pm 1/16$ -inch, 20-inch and larger.
- e. Gaskets: EDPM, full face, 1/8-inch minimum thickness.
- f. Bolts, Nuts and Washer: Type 316 stainless steel.
- 4. Joints:
 - a. Type: Butt and wrap in accordance with VPS PS 15-69.
 - b. Field Weld Kits: Furnished by manufacturer, consisting of fiberglass and reinforcing material, pre-cut and individually packaged for each joint. Bulk glass rolls will not be acceptable.
 - c. Resin, Catalyst and Putty: Furnished in bulk, plus 10% extra for waste.

2.03 EXPANSION JOINTS

- A. General:
 - 1. Provide where shown on Drawings.
 - 2. Unless otherwise specified or indicated on Drawings, flanged where connecting ductwork to equipment, otherwise slip-type will be acceptable.
- B. Construction:
 - 1. Type: W-design configuration with integral flanges suitable for service with FRP ductwork under conditions specified.
 - 2. Backing Rings: 3/8-inch thick, 2-inches wide, Type 316 stainless steel where flanged joints or flexible joints noted.
 - 3. Extension: 3-inches.
 - 4. Compression: 2-1/2 inches.
 - 5. Lateral Offset: 2-1/2 inches.
 - 6. Thickness: 1/4-inch minimum.
 - 7. Bolts, Nuts and Washers: Type 316 stainless steel.

2.04 BUTTERFLY DAMPERS

- A. Round Fiberglass Reinforced Plastic Dampers:
 - 1. Type: Butterfly.
 - 2. Corrosion Resistant: Comply with requirements for ductwork.
 - 3. Leakage:
 - a. Balancing: 3 cfm/sq. ft. at 10-inches WC maximum.
 - b. Isolation: 5.25 cfm/sq. ft. at 30-inches WC maximum.
 - c. Unless otherwise shown on Drawings, all dampers shall be isolation.
 - 4. Fabrication:
 - a. Frame and Blade: Premium vinyl ester, with blade fully encapsulating shaft.
 - b. Shaft: Premium vinyl ester for manually actuated dampers.
 - c. Bearings and Bushings: Teflon.
 - d. Pins and Hardware: Type 316 stainless steel.
 - e. Blade Stop: Provide consisting of FRP angles with full circumference EDPM seals.
 - f. Flanged ends with Type 316 hardware.
 - g. Damper Operator:
 - 1) Size, 24-Inch and Smaller: Hand quadrant actuator fabricated of Type 316 stainless steel with a 5-stage locking device.
 - 2) Size, Larger than 24-Inches: Unless otherwise specified, provide gear operator with an epoxy coating.
 - 3) Balancing Dampers: Fully adjustable slot with extra hole drilled in handle to permit "drill and pin-in place" once system is balanced.
 - 4) Isolation Damper: Bear the AMCA seal.
 - 5) Valve Box with Operating Stem extending to the ground surface and position indicator that identifies direction and number of turns to open or close the damper: Provide on buried balancing dampers.

5. Protect the flanged joints, gaskets and hardware of buried dampers with protective wrapping before burying. Encasement for wrapping buried control dampers shall be installed according to AWWA C105 and shall be as follows:
 - a. Form: Sheet or tube.
 - b. Material: LLDPE film of 0.008-inch minimum thickness or high-density, cross-laminated PE film of 0.004-inch minimum thickness.
 - c. Color: Black.

2.05 DUCT HANGERS AND SUPPORTS

- A. Hangers and supports shall comply with the requirements of Division 15 Section "Hangers and Supports for Piping Systems" with the spacing complying with the requirements listed in the table below.

Duct Inside Diameter (inches)	Maximum Span (feet)
3 - 18	10
20 - 24	15
30 - 36	20

- B. Duct Support Locations:
 1. General: Not all locations are shown on the Drawings and CONTRACTOR shall be responsible for the design of additional supports and for overall stability of the ductwork system.
 2. Exterior Supports:
 - a. Designed to include weight of duct and to withstand applicable combinations of wind and seismic loadings in accordance with the applicable building codes.
 - b. Support shall be of the "saddle type" as shown on the Drawings.
 - c. Locations shown on the Drawings are approximate and CONTRACTOR shall confirm support requirements and locations.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General:
 1. Examination: Prior to installation, each duct length and fittings shall be inspected, flushed clean of any debris or dust, and straightened if not true.
 2. Install ductwork in a neat and workmanlike manner, properly aligned, and cut from measurements taken at the site to avoid interferences with structural members, architectural features, openings and equipment.
 3. Exposed ducts shall afford maximum headroom and access to equipment, and where necessary, installed with sufficient slopes for venting and drainage of liquids and condensate to low points.
 4. Protect the flanged joints, gaskets and hardware of buried dampers with manufacturer recommended wrapping before burying.
 5. CONTRACTOR shall obtain training by manufacturer's field representative in the correct installation and support of the ductwork.
- B. Supports and Anchors:
 1. Ductwork shall be firmly supported with fabricated or commercial hangers and supports in accordance with the requirements of Division 15 Section "Hangers and Supports for Piping Systems" and as described in Part 2 – Products.
 2. Provide supports at equipment and structural members to avoid stress on ductwork and the connecting items.

3.02 DUCTWORK JOINTS

A. Butt and Wrap Joints:

1. Prior to joining, ends shall be ground smooth. Remove all debris and dust.
2. Ends shall be resin-coated.
3. Ductwork, 24-Inch and Larger: Apply and interior corrosion wrap.
4. Butt and wrap sequence shall be as specified by ductwork manufacturer to the thickness indicated on the shop drawings.

3.03 INSPECTION AND FIELD TESTING

A. Inspection: Inspect finished installation for proper joints and sufficient supports, anchoring, interference, and damage to ductwork, fittings and coating. Repair damaged to the satisfaction of the ENGINEER.

B. Field Testing:

1. CONTRACTOR shall provide all test equipment, labor, materials and devices at no extra cost to OWNER.
2. Ductwork system shall be tested to 1-1/2 times the maximum working pressure.
3. Leakage may be determined by loss of pressure, soap solution, chemical indicator, or other positive and accurate method.
4. All fixtures, devices, or other accessories connected to the ductwork system, which could be damaged if subjected to the test pressure, shall be disconnected and ends of the branch lines plugged or capped.
5. Repair leaks and retest ductwork system.

END OF SECTION

Section 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic requirements specifically applicable to the work of Division 16 - Electrical Requirements.
- B. The Contractor shall furnish equipment, materials, and labor for assembly and installation plus check-out and start-up of the complete electrical system as shown on the Drawings and stipulated in the Specifications.

1.02 REFERENCES

- A. As a minimum requirement, the electrical system shall be constructed in accordance with:
 - 1. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), No. 70 - National Electrical Code (NEC).. The contractor shall provide all electrical work / installations based on the latest addition of the NEC.
 - 2. City of Houston Building Code.
 - 3. Other applicable Codes and Standards as referenced in other Master Specifications.
- B. Comply with local, county, state and federal regulations and codes in effect as of date of purchase.
- C. Equipment of foreign manufacture must meet U.S. codes and standards.
- D. Equipment and materials shall conform to requirements of specification and to the criteria provided in data sheets for the project.

1.03 QUALITY ASSURANCE

- A. Product Conformance Certificate and Quality Assurance Release. Submit an overall conformance certificate for electrical components signed by the person responsible for product quality. Specifically identify the purchased material or equipment by project name and location, purchase order number, supplements, and item number where applicable, including materials and services provided by others.

BASIC ELECTRICAL REQUIREMENT

Indicate that all requirements have been met and identify any approved deviations.

B. Field Inspection

1. Electrical work shall be inspected and approved by the local code inspectors, the wastewater inspectors, and the Project Manager prior to starting the 7-day test or scheduling training.
2. Contractor shall give a minimum of two days notice to the Inspectors that the installation is ready for inspection and two days notice to the Project Manager.
3. Concealed work shall be inspected and approved by code inspectors and wastewater inspectors before it is covered:
 - a. Conduit with stub-ups, underground in duct banks before concrete is poured. Conduit in slabs, walls and ceilings, complete with boxes.
4. Electrical equipment and materials shall be inspected upon arrival by the Project Manager for compliance with specifications.

1.04 SITE CONDITIONS**A. Take the following site conditions into consideration when fabricating, erecting, installing and wiring electrical equipment under this contract:**

1. Plant Location _____
Houston, Texas
2. Plant Type and Size _____
3. Plant Site Elevation _____
4. Seismic Zone Zone 0
5. Wind Velocity 90 mph
6. Temperature, Min./Max.:
 - Coldest Winter Month High 60 degrees F Low 41 degrees F
 - Warmest Summer Month High 94 degrees F Low 73 degrees F
 - Lowest Expected 11 degrees F
 - Highest Expected 107 degrees F

7. Rainfall:
 - Annual 45 inches
 - Design 3.4 inches/hour, 8.4 inches/24 hours
8. Design Relative Humidity: 98%
9. Station Barometric Pressure:
 - Average Annual 29.5 inches Hg Absolute.
10. Utility Water Systems: Design Pressure Design Temp.
 - River Water _____ PSI _____ degrees F
 - Well Water _____ PSI _____ degrees F
 - City Water _____ PSI _____ degrees F
11. Electric Power Supply Characteristics (Available to Contractor):

	Voltage	Phase	Hz	Wire	Delta or Wye
1					
2					
3					

PART 2 PRODUCTS

2.01 COMPONENT DESIGN

- A. Components utilized in the construction of the material or equipment shall be of the latest proven design, new and in current production. Do not use obsolete components or components to be phased out of production.

2.02 FACTORY INSPECTION

- A. Provide free access with prior notice for the Project Manager at all times to the shop where the material or equipment is being fabricated or tested. Provide reasonable facilities for inspection, witnessing tests, and examining records. Give 7-days notice prior to starting tests which are scheduled for factory inspection.

BASIC ELECTRICAL REQUIREMENT

PART 3 EXECUTION

3.01 INSTALLATION

PREPARATION

- A. Verify dimensions and ratings of equipment and materials to ensure proper fit and performance.

3.02 INSTALLATION

- A. Install equipment and materials in accordance with the Drawings and manufacturer's written instructions. If field conditions necessitate changes in electrical installation, obtain approval from the City Engineer.
- B. Conductor voltage drop shall not exceed 2 percent for feeders and 3 percent for branch circuits.

3.03 DEMONSTRATION

- A. Test the electrical system to specification requirements and to demonstrate correct installation and operation of equipment. O & M Manual shall be furnished prior to testing for reference during testing and corrections for final O & M.
- B. Before 7-days test, demonstrate the system to the wastewater inspectors and the Project Manager. Show the system to be fully operational. All alarms, safeties, and communication points to central and locally must operate in both full-automatic and back-up modes. Use fresh water in the test medium.
- C. Operate the system continuously for a period of 7 days in full automatic, without failure, to qualify as acceptable. "Failure" is considered any problem that requires correction by process control instructions, maintenance personnel, such as: high or low water level, any motor alarm, power failure, phase failure, communication failure, PLC failure, process control software failure, requiring rewriting or transducer failure. This would exclude conditions not under the control of Contractor, such as: evident lightning strikes, 25-year rains, local power utility power failure longer than the specified duration of service. Failures due to uncontrollable situations would allow the 7-day test to continue, as soon as test conditions are restored and the City Engineer is notified.
- D. The existing station shall remain in service during this test.

END OF SECTION

Section 16060

ELECTRICAL DEMOLITION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Electrical demolition.

1.02 REFERENCES

- A. Temporary wiring of systems to maintain operation of facilities while undergoing modifications and demolition shall be provided in accordance with:
 - 1. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), No. 70 - National Electrical Code (NEC), Article No. 590 - Temporary Wiring
 - 2. City of Houston Electrical Code.

1.03 SUBMITTALS

- A. Annotate existing drawings to sequence the demolition of systems, equipment removal and temporary hook-ups.
- B. Schedule with Project Manager for required shut-downs to accommodate system demolition and installation of temporary facilities.

1.04 QUALITY ASSURANCE

- A. Verify field measurements and circuiting arrangements are as shown on Drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to City Engineer before disturbing existing installation.
- D. By beginning demolition, installer accepts existing conditions and warrants that he will maintain service to equipment and items not scheduled or indicated for removal, and that he will return to the City all items and systems in good operating condition.

ELECTRICAL DEMOLITION

PART 2 P R O D U C T S

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual Sections.

2.02 DESIGN AND CONSTRUCTION

- A. The temporary electrical wiring and facilities shall be designed and constructed in strict compliance with NEC - Article No. 590 and the City of Houston Electrical Code.

PART 3 E X E C U T I O N

3.01 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Coordinate utility service outages with utility company to provide continuous service to operating equipment.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, notify City of Houston Utility Operations and get approval. Use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the City Engineer at least one week before partially or completely disabling system. Minimize outage duration.
- E. Adding Load to Existing Electrical System: Perform a load analysis to assure that the existing power distribution system (MCC, service, conductors, panel, breakers, feeders, branch circuits, etc.) is not overloaded if additional load is added to existing equipment.
- F. Existing electrical conduit and wire may not be reused to feed new equipment except by written authorization from the City of Houston.

3.02 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Remove, relocate, and extend existing installations to accommodate new construction.
- B. Remove abandoned wiring to source of supply.

- C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. This includes all associated support and anchoring systems. Cut conduit flush with walls and floors, and patch surfaces.
- D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- E. Disconnect and remove abandoned panelboards and distribution equipment.
- F. Disconnect and remove electrical wire, conduits, devices and equipment serving utilization equipment that has been removed.
- G. Repair adjacent construction and finishes damaged during demolition and extension work. Repairs to include matching material type and color.
- H. Maintain access to existing installations which remain active. Modify installation or provide access panel as appropriate. Cut abandon conduits in floors or slabs flush to surface, fill with concrete and path to match surface type and color.
- I. Extend existing installations using materials and methods as specified for new work.

3.03 DISPOSAL AND SALVAGE

- A. Salvage electrical and instrumentation equipment and wiring size four and larger removed from existing facilities for City's reuse.
- B. Material and equipment which can be reused or salvaged remains the property of the City of Houston. Equipment to be retained by the City of Houston shall be delivered to a specified location by the Contractor.
- C. Materials and equipment which cannot be reused or salvaged will be removed and disposed by the Contractor.

3.04 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

3.05 INSTALLATION

- A. Install relocated materials and equipment under the provisions of Section 02220 - Demolition.

ELECTRICAL DEMOLITION

- B. Electrical installations and materials shall conform to the current issue of the following standard and codes: American National Standards Institute/National Fire Protection Association (ANSI/NFPA), No. 70 - National Electrical Code (NEC), City of Houston Electrical Code, and material and workmanship.
- C. All material shall be free of defects and in safe working condition which will meet electrical classification and functional requirements.
- D. Testing shall be made during the course of construction or at the completion of the job. These tests shall be made by the electrical contractor. The contractor shall furnish all test equipment.
- E. The job will not be complete until work has been inspected and trial startup has been successfully completed.

END OF SECTION

Section 16111

CONDUIT, FITTINGS, AND BODIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Conduit, fittings, and bodies.

1.02 REFERENCES

- A. American National Standards Institute (ANSI):

- 1. ANSI C 80.1 - Rigid Steel Conduit - Zinc Coated.
- 2. ANSI C 80.4 - Fittings for Rigid Metal Conduit.

- B. American Society for Testing and Materials (PVC Coated Conduit)

- 1. ASTM D149-09 – Standard test method for dielectric breakdown voltage and dielectric strength of solid electrical insulating materials at commercial power frequencies.
- 2. ASTM D1735-08 – Standard practice for testing water resistance of coatings using water fog apparatus.
- 3. ASTM D2247-11 – Standard practice for testing water resistance of coatings in 100% relative humidity.
- 4. ASTM D2240-05 (2010) – Standard test method for rubber property – durometer hardness.
- 5. ASTM D1308-02 (2007) – Standard test method for effect of household chemicals on clear and pigmented organic finishes.
- 6. ASTM D638-10 – Standard test method for tensile properties of plastics.
- 7. ASTM D746-07 – Standard test method for brittleness temperature of plastics and elastomers by impact.
- 8. ASTM D1151-00 (2006) – Standard practice for effect of moisture and temperature on adhesive bonds.

CONDUIT, FITTINGS, AND BODIES

9. ASTM D870-09 – Standard practice for testing water resistance of coatings using water immersion.
 10. ASTM G152-06 – Standard practice for operating open flame carbon arc light apparatus for exposure of non-metallic materials.
 11. ASTM G153-04 (2010) – Standard practice for operating enclosed carbon arc light apparatus for exposure of non-metallic materials.
 12. ASTM D3359-09e2 – Standard test methods for measuring adhesion by tape test.
 13. ASTM D4585-07 – Standard practice for testing water resistance of coatings using controlled condensation.
- C. ASTM B571-97 (2008)e1 – Standard practice for qualitative adhesion testing of metallic coatings
- D. Federal Specifications:
1. W-C-58 C - Conduit Outlet Boxes, Bodies Aluminum and Malleable Iron.
 2. W-C-1094 - Conduit and Conduit Fittings Plastic, Rigid.
 3. WW-C-566 C - Flexible Metal Conduit.
 4. WW-C-581 D - Coatings on Steel Conduit.
- E. National Electrical Manufacturers Association (NEMA):
1. NEMA RN 1 - Polyvinyl-Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing.
 2. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
 3. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- F. National Fire Protection Association (NFPA), ANSI/NFPA 70 - National Electrical Code (NEC).
- G. Underwriters' Laboratories (UL):
1. UL 1 - Flexible Metal Electrical Conduit.

2. UL 6 - Rigid Metal Electrical Conduit.
3. UL 514 B - Fittings for Conduit and Outlet Boxes.
4. UL 651 - Schedule 80 Rigid PVC Conduit.
5. UL 651 A - Type EB and A Rigid PVC Conduit and HDPE Conduit.
6. UL 886 - Electrical Outlet Boxes and Fittings for Use in Hazardous Locations.

H. City of Houston Electrical Code.

1.03 SUBMITTALS

A. Make submittals following Section 01330 - Submittal Procedures:

1. Manufacturer's cut sheets, catalog data.
2. Installation, terminating and splicing procedure.
3. Instruction for handling and storage.
4. Dimensions and weight of products.
5. Code compliance certificate.
6. Conformance certificate.

1.04 QUALITY ASSURANCE

- A. Rigid steel conduit shall pass the bending, ductility, and thickness of zinc coating test described by ANSI C 80.1.
- B. Flexible conduit shall pass the tension, flexibility, impact, and zinc coating test described by UL 1.
- C. Nonmetallic conduit and fittings shall pass the test requirements of NEMA TC 2, UL 65 and 651 A and Federal Specification W-C-1094 A.
- D. The PVC coated conduit must be listed by UL with both the zinc coating and PVC coating each serving as primary coatings by itself under UL6.

1.05 DELIVERY STORAGE AND HANDLING

CONDUIT, FITTINGS, AND BODIES

- A. Package conduit in 10-foot bundles maximum with conduit and coupling thread protectors suitable for indoor and outdoor storage. Package fittings in manufacturer's standard quantities and packaging suitable for indoor storage. Package plastic-coated rigid conduit, fittings, and bodies in such a manner as to protect the coating from damage during shipment and storage.
- B. Store conduit above ground on racks to prevent corrosion and entrance of debris.
- C. Protect plastic conduit from sunlight.

PART 2 P R O D U C T S

2.01 ACCEPTABLE MANUFACTURERS

- A. Rigid Aluminum Conduit:
 - 1. Allied Tube and Conduit.
 - 2. Triangle Wire and Cable, Inc.
 - 3. Wheatland Tube Company.
- B. PVC Coated Aluminum Conduit:
 - 1. Occidental Coating Company (O-Cal Blue).
 - 2. Robroy Industries, Inc.
 - a. Rob-Roy Red
 - b. Plasti-Bond Red
 - c. Perma-Cote Green
 - d. Calbond
- C. PVC Rigid Sch 80 Conduit:
 - 1. Allied Tube & Conduit.
 - 2. Cantex.
 - 3. Osburn Associates, Inc.

- D. Conduit Fittings and Bodies:
 - 1. Appleton Electric.
 - 2. Crouse-Hinds.
 - 3. Hubbell - Killark Manufacturing Company.
 - 4. O-Z/Gedney.
- E. Liquidtight Flexible Conduit:
 - 1. Anamet, Inc.
 - 2. Electriflex Company.
 - 3. Triangle Wire and Cable, Inc.

2.02 MATERIALS AND EQUIPMENT

- A. Design Conditions. Use electrical conduit, fittings, and bodies designed for service in areas as specified in Section 16010 - Basic Electrical Requirements and this section to form a continuous support system for power, control, and instrument cables or any combination thereof.
- B. Conduit and Fittings:
 - 1. Rigid Steel Conduit and Fittings.
 - a. Rigid steel conduit and rigid steel conduit bends, nipples, and bodies shall be hot-dipped galvanized and shall comply with the latest ANSI C 80.1, UL 6, Federal Specification WW-C-581 D, and NEC Article 346-15.
 - b. Mild steel tubing shall be used for conduit, nipples, and couplings, and shall be free of defects on both the inner and outer surfaces.
 - c. Fittings and bodies and covers for rigid steel conduit shall be steel or cast-iron and shall comply with ANSI C 80.4, UL 514 B, and Federal Specification W-C-58 C.
 - 2. PVC-Coated Rigid Steel Conduit and Fittings

CONDUIT, FITTINGS, AND BODIES

- a. PVC-coated conduit, fittings, bodies, and covers shall conform in all respects to NEMA RN 1 (Type A). Rigid steel galvanized conduit and fittings shall conform to Federal Specifications WW-C-581 D and ANSI C 80.1.
 - b. The PVC coated conduit must be listed by UL with both the zinc coating and the PVC coating each serving as primary coatings by itself under UL6. Conduit bodies shall conform to UL 514 B and Federal Specification W-C-58 C. PVC-coated fittings for general service locations must be UL listed with the PVC as the primary corrosion protection. Provide sufficient coating for touch-up after installation.
 - c. Condulet covers shall have encapsulated stainless steel thumb screws.
 - d. Condulets and covers shall be of malleable iron or ferroalloy material before coating.
 - e. Urethane coating shall be a minimum of 2 mil thickness on the interior of the conduit and the interior of fittings, condulets, covers, and bodies.
 - f. Form 8 fittings shall have an o-ring molded with the coating of their covers. The fittings shall pass a UL observed pressure and vacuum test retaining 25" of vacuum and 17 PSI of pressure for a period of 80 hours.
3. Liquidtight Flexible Metal Conduit and Fittings
- a. Use liquidtight flexible metal conduit manufactured in accordance with UL 1 and Federal specification WW-C-566 C.
 - b. Fittings used with liquidtight flexible metal conduit shall be the PVC-coated type. Thoroughly ground the conduit to the fittings and through the fittings to the box or enclosure to which it is attached.
 - c. Couplings and fittings for use in hazardous areas shall comply with UL 886, NEC Article 501 & 502, and Federal Specification W-C-586 C.
4. PVC Conduit and Fittings. Use PVC conduit, bends, and fittings, which comply with NEMA TC 2, W-C-A, and NBC Article 347-17 for above ground installation. Underground installations refer to 16402. Conduit

shall be Schedule 80.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ensure that the conduit system to be installed is sized properly for the cable and wire requirements.
- B. Verify the actual physical conduit route from the conduit plan drawings and prepare the conduit support system.
- C. Verify the equipment locations to which the conduit will be connected and determine detail requirements for connections.

3.02 INSTALLATION

- A. Install PVC-coated rigid aluminum conduits in all outdoor locations, inside valve vaults and wet wells, lift station dry pits, areas that are not air-conditioned, and in all other corrosive and wet environments. Install PVC-coated conduit in strict accordance with manufacturer's instructions. Use installers certified by the manufacturer.
- B. Install rigid galvanized steel (RGS) conduits in dry, inside, air-conditioned locations only.
- C. Install PVC SCH 80 conduits in reinforced duct banks or encased in concrete slabs. For stub-ups, use PVC coated rigid aluminum elbows as required in Section 16402.
- D. Run exposed conduit parallel or perpendicular to walls, ceilings or main structural members. Group multiple conduits together where possible. Conduit shall not interfere with the use of passageways, doorways, overhead cranes, monorails, equipment removal areas or working areas. In no case shall conduit routing present a safety hazard, trip hazard, or interfere with normal plant operating and maintenance procedures. A minimum overhead clearance of 8 feet shall be maintained in passageways. All conduits installed across walkways shall have concrete or aluminum trip plates installed.
- E. Installation and support of conduit shall be from steel or concrete structures in accordance with the standard detail drawings. Furnish necessary conduit straps, clamps, fittings and support for the conduit in accordance with the standard details.
- F. Identify conduit at termination points like MCC, light fixtures, control panels, receptacles, panels, and junction boxes.

CONDUIT, FITTINGS, AND BODIES

- G. Not more than 3 equivalent 90 degree bends will be permitted between outlets. Provide bonded expansion fittings at building expansion joints.
- H. Install conduit runs so that they are mechanically secure, mechanically protected from physical harm, electrically continuous, and neat in appearance. The interiors of conduit shall provide clean, smooth raceways through which conductors may be drawn without damage to the insulation. Make threaded connections wrench tight.
- I. Cut conduit square with a power saw or a rotary type conduit cutter designed to leave a flat face. Do not use plumbing pipe cutters for cutting conduit. Ream the cut ends of conduit with a reamer, designed for the purpose to eliminate rough edges and burrs. Threads shall be cut with standard conduit dies providing 3/4-inch taper per foot, allowing the proper length so that joints and terminals may be made up tight and the ends of the conduit not deformed. Keep dies sharp and use a good quality threading oil continuously during the threading operation. Remove metal cuttings and oil from the conduit ends after the threads are cut coat threads with ALUMA-SHIELD or equal before connections are made
- J. Use strap wrenches only to tighten joints in plastic coated rigid aluminum conduit. Replace all conduit and fittings with damage to the plastic coating, such as cuts, nicks and threader chuck jaw marks. Use a solvent, or the same patching material to seal around the edges of conduit fitting covers.
- K. Make changes in direction of conduit using elbows or fittings. Do not use pull boxes to make direction changes unless specifically designated otherwise.
- L. Field fabricated bends shall be free of indentations or elliptical sections. The radius of the bend shall not be less than 6 times the smallest diameter of the raceway.
- M. Protect all conduit terminations from mechanical injury. Prevent the entry of moisture and foreign matter into the conduit system by properly capping terminations.
- N. Avoid trapped runs of conduit, if possible. When they are necessary, provide drainage using a "tee" conduit equipped with a drain. Conduit is likely to pass through areas with a temperature differential of 20 F or more. Seal penetrations with a proper seal fitting at the wall or barrier between such areas. For conduit passing through walls separating pressurized areas from non-pressurized areas, install sealing fittings at the wall on the non-pressurized side.

- O. Fit all conduit crossing building or structure expansion joints with approved expansion fittings, except that fittings will not be required when conduit crossing an expansion joint is supported on trapeze hangers in such a way that at no time will the conduit be under stress due to expansion. Unless otherwise indicated on Drawings, install expansion fittings every 300 feet within a straight conduit run and where conduit crosses building expansion joints, using bonding straps to ensure ground continuity. Bonding strap connections shall be protected by minimum 40 mils PVC coating.
- P. Where rigid aluminum conduit terminates in sheet metal enclosures, fit the conduit with double locknuts and bushings. Sheet metal enclosures made of stainless steel or aluminum located outside or in any other wet, damp, or corrosive areas shall be furnished with PVC-coated threaded hubs. Restrict side penetrations to the lower one third of the enclosure. Where PVC-coated rigid conduit is used, PVC-coated rigid threaded hubs will be used.
- Q. Provide flexible Liquidtight metallic conduit where necessary to allow for movement or to localize sound or vibration, at transformers, at motors and any other rotating equipment. Flexible metal conduit shall be used as fixture whips only.
- R. Seal all openings or holes where conduits pass through walls or floors. When passing through a firewall or floor, use a fire-rated seal per the typical detail included in the Drawings. Certain walls, as indicated on the drawings, require environmental (air-tight) seals; seal as indicated on the Drawings.
- S. Install explosion-proof seals according to N.E.C. requirements and in coordination with NFPA 820, in conduit runs crossing or entering hazardous classified areas (as shown on Drawings). Install type CSBE removable sealing fittings to seal pump cables between wet well and first junction box. If a junction box is not used, install the CSBE seals at the wet well and the control panel.
- T. All transitions in PVC-coated conduit size shall be accomplished with PVC-coated RECs or manufactured reducing condulets. RE bushings shall not be used.
- U. Parallel runs of conduit may be supported by structural steel racks. When two or more racks are arranged one above the other, provide vertical separation of not less than 12 inches between racks, unless otherwise indicated on Drawings. Space conduits on the racks at least enough to provide 1/4-inch clearance between hubs on adjacent conduits at terminations and to allow room for fittings.
- V. Fill conduit racks no more than 75 percent of their capacity, providing usable space for future conduit. To ensure this, conduits leaving the rack horizontally

CONDUIT, FITTINGS, AND BODIES

shall be offset up or down so that future conduits may be installed in the space remaining. Construct conduit racks to permit access for wire or cable pulling at all pull points, even when future conduits are added to fill the racks.

- W. Where conduit racks are supported on rods from beam clamps or by some other non-rigid suspension system, install rigid supports at no more than 50-foot intervals to give lateral stability to the rack.
- X. Conduit racks or hangers must in no way interfere with machinery (or its operation), piping, structural members, process equipment, or access to anticipated future equipment. Refer to architectural, structural, equipment layout and piping drawings to ensure that this requirement is met. Label high voltage conduit with the circuit phase-to-phase voltage by means of a firmly attached tag or label of approved design at each conduit termination, on each side of walls or barriers pierced and at intervals not exceeding 200 feet along the entire length of the conduit.
- Y. Support conduit sizes 2 inches and larger at spacing's not exceeding 10 feet and conduit sizes 1-1/2 inches and smaller at spacing's not exceeding 8 feet.
- Z. The means of fastening conduit to supports shall be: by one hole malleable iron conduit straps secured by wood screws to wood and by bolts with expansion anchors to concrete or masonry; by "Korn" clamps or U-bolts to other surfaces. Use "clamp backs" when strapping conduits to walls, column faces, or other such surfaces.
- AA. Support conduit runs with conduit clamps, hangers, straps and metal framing channel attached to structural steel members. Conduits of 1-1/2 inch size or less may be supported by one-hole conduit straps on concrete, tile or steel work, but for larger size conduit, 2-hole straps shall be used. Use clamps of galvanized malleable iron for rigid galvanized conduit and stainless steel for PVC-coated conduit. Metal framing channel straps used for PVC-coated conduit shall be type 316 stainless steel.
- BB. Install conduits supported form building walls with at least 1/4-inch clearance from the wall to prevent the accumulation of dirt and moisture behind conduit.
- CC. All Conduits embedded in concrete lift station deck shall be PVC-coated rigid aluminum.

END OF SECTION

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Section 16120

600-VOLT BUILDING WIRE AND CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specifications for 600-volt building wire and cable.

1.02 REFERENCES

- A. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), NFPA 70 - National Electrical Code (NEC), Article 310 - Conductors for General Wiring
- B. Underwriter's Laboratories (UL)
 - 1. UL 83: Thermoplastic Insulated Wires and Cables
 - 2. UL 1063: Machine Tool Wires and Cables
- C. American Society for Testing and Materials (ASTM)
 - 1. ASTM B 3: Soft or Annealed Copper Wires
 - 2. ASTM B 8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft
- D. Insulated Cable Engineers Association (ICEA), ICEA S-61-402: Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-5)
- E. City of Houston Electrical Code

1.03 SUBMITTALS

- A. Make submittals following Section 01330 - Submittal Procedures.
 - 1. Manufacturer's cut sheets, catalog data
 - 2. Instruction for handling and storage
 - 3. Dimensions and weight
 - 4. Conformance certificate

600-VOLT BUILDING WIRE AND CABLE

1.04 QUALITY ASSURANCE

- A. Tests Cable shall meet all the requirements of Part 6 of ICEA S-61-402.
- B. Conformance Certificate and Quality Assurance Release: Submit a conformance certificate signed by the person responsible for product quality. The certificate shall specifically identify the purchased material or equipment; such as by the project name and location, purchase order number, supplements, and item number where applicable, including materials and services provided by others. The certificate shall indicate that requirements have been met and identify any approved deviations.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Ship wire and cable on manufacturer's standard reel sizes unless otherwise specified. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel. Provide moisture protection by using manufacturer's standard procedure or heat shrinkable self-sealing end caps applied to both ends of the cable.

PART 2 P R O D U C T S

2.01 ACCEPTABLE MANUFACTURERS

- A. American Insulated Wire Corporation
- B. Southwire Company
- C. General Cable Company
- D. Superior Essex
- E. Rome Cable Company
- F. Triangle Wire and Cable, Inc.

2.02 MATERIALS AND EQUIPMENT

- A. Design. Provide cable designated as THWN/THHN stranded single conductor type and UL 83 and UL 1063 listed, rated 600 volts and certified for continuous operation at maximum conductor temperature of 90 C in dry locations and 75 C in wet locations in conduit. MTW stranded will be used in control panels.

- B. Conductors. Provide conductors which are Class B, concentric stranded, annealed uncoated copper with physical and electrical properties complying with ASTM B 3 and ASTM B 8 and Part 2 of ICEA S-61-402.
- C. Insulation.
 - 1. Each conductor shall be PVC insulated and nylon jacketed to meet the requirements of Part 3 of ICEA S-61-402. The insulation thickness shall match the dimensions listed in Table 310.104(A) of the National Electrical Code (NEC) for type THHN/THWN wire.
 - 2. Outdoor conductors installed in conduit exposed to sunlight shall be Type XHHW-2 stranded copper conductors, moisture, and heat resistant cross-linked polyethylene (XLP). Conductors shall meet or exceed UL Standard 44, Federal Specification A-A-59544, and requirements of the National Electrical Code. Type XHHW-2 meets and exceeds all construction requirements of ICEA S-95-658 (NEMA WC 70).
- D. Wire Marking
 - 1. Wire marking shall be in accordance with National Electrical Code (NEC) Article 310.120.
 - 2. The printing method used shall be according to (NEC) 310.120(B).
- E. The single conductor color coding shall be as follows:

<u>System Voltage</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Neutral</u>
120/208 Volt 3Ph/4w	Black	Red.....	Blue	White
120/240 Volt 3Ph/4w	Black	Orange	Blue	White
277/480 Volt 3Ph/4w	Brown	Purple	Yellow	Grey
Motor Control	1	Black		
	2	Red		
	3	Blue		
Ground	Green		

PART 3 EXECUTION

3.01 PREPARATION

- A. Complete the cable raceway systems and underground duct banks before installing cables.

600-VOLT BUILDING WIRE AND CABLE

- B. Verify sizing of raceways and pullboxes to ensure proper accommodation for the cables according to (NEC) minimum requirements or as specified on drawings.
- C. Check the length of the cable raceway system against the length of cable on the selected reel.
- D. Clean and swab conduits of foreign matter before cables are pulled.

3.02 INSTALLATION

A. Wiring Methods

1. Use wiring methods indicated on Drawings.
2. In general, use THHN/THWN stranded building wire for lighting, power and control wiring where conductors are enclosed in raceways like in above ground conduit system or in underground duct banks, or inside control panels.
3. Use XHHW-2 stranded building wire in outdoor areas power and control wire is in conduit exposed to direct sunlight. Refer to (NEC) 310.15(B)(3)(a)(5)(c) Exception.
4. Do not use solid conductors.
5. Use conductors not smaller than No. 12 AWG stranded for general lighting circuits.
6. Use conductors not smaller than No. 14 AWG stranded for control circuits, except when part of a multiconductor cable or internal panel wiring.
7. In general, do not splice conductors unless approved by the City Engineer.
8. Splices associated with taps for lighting and control circuits are allowed without approval.
9. Make splices in accessible junction boxes.

B. Single Conductor in Conduit and Ductbank

1. Install cables in accordance with the manufacturer's instructions and the National Electrical Code (NEC), Chapter 3- Wiring

Methods and Materials. Do not exceed maximum wire tension, maximum insulation pressure and minimum bending radius.

2. Pull cables into conduits using wire pulling compounds approved by cable manufacturers to reduce friction. Lubricants must not be harmful to the conductor insulation. Mixtures containing soap or detergent shall not be used.

C. Single Conductor in Cable Tray

1. Do not install single conductor building wire and cable in cable tray.
2. For single conductor tray installation, see Section 16122 - 600 Volt Power Cable.

D. Preparation for Termination

1. Make 600-volt power cable terminations and splices with heat shrinkable sleeves and seals.
2. Terminal lugs and connectors for all sizes of conductors shall be crimp-on type.
3. For size 1/0 AWG and larger, crimp-on lugs shall have the long barrel with 2-hole tongues except in places where termination space is limited.

E. Tests

1. In general, test insulation integrity of the wiring system before terminating.
2. Make sure to disconnect sensitive electronic equipment before testing insulation.
3. Use a 600 VDC megohmmeter and perform the wire system insulation test in accordance with the operating instructions.

F. Termination. After the 600-volt wiring system has been tested with satisfactory results, reconnect wire.

END OF SECTION

600-VOLT BUILDING WIRE AND CABLE

11th Street Facility Odor Control
WBS No.: R-000020-0010-3

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Section 16121

600-VOLT CONTROL CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. 600-volt control cable.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM B 3 - Soft or Annealed Copper Wires.
 - 2. ASTM B 8 - Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft.
 - 3. ASTM B 33 - Tinned Soft or Annealed Copper Wire for Electrical Purposes.
 - 4. ASTM B 174 - Bunch-stranded Copper Conductors for Electrical Conductors.
- B. Institute of Electrical and Electronics Engineers (IEEE), IEEE 383-2.5: IEEE Standard for Type Test of Class IE Electric Cables and Field Splices.
- C. Insulated Cable Engineers Association (ICEA):
 - 1. ICEA S-61-402 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-5).
 - 2. ICEA S-66-524 - Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-7).
 - 3. ICEA S-68-516 - Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-8).
- D. Underwriters' Laboratories (UL):
 - 1. UL 44 - Rubber Insulated Wires and Cables.
 - 2. UL 83 - Thermoplastic Insulated Wire and Cables.

600-VOLT CONTROL CABLE

- E. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), No. 70 - National Electrical Code (NEC) , Chapter No.3 - Wiring Methods and Materials, Article 725 - Class 1, Class 2, and Class 3 Remote Control, Signaling, and Power-Limited Circuits.

1.03 SUBMITTALS

- A. Make submittals following Section 01330 - Submittal Procedures.
 - 1. Completed engineer's data sheets.
 - 2. Completed manufacturer's data sheets.
 - 3. Manufacturer's cut sheets, catalog data.
 - 4. Installation, terminating and splicing procedure.
 - 5. Instruction for handling and storage.
 - 6. Dimensions and weight.
 - 7. Conformance certificate.

1.04 QUALITY ASSURANCE

- B. Tests.
 - 1. Cable shall be tested at the factory to confirm that the cable complies with requirements of Part 6 of ICEA S-61-402, S-66-524 or S-68-516. Refer to data sheet for additional test requirements.
 - 2. Where applicable, the cable shall meet the requirements of the vertical tray flame test as described in IEEE 383-2.5.

1.05 DELIVERY STORAGE AND HANDLING

- A. Ship cable on manufacturer's standard reel sizes, unless otherwise specified. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable. Reels shall be of the type specified on the data sheets. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel. Provide moisture protection by manufacturer's standard procedure or heat shrinkable self-sealing end caps applied to both ends of the cable.

PART 2 P R O D U C T S

2.01 ACCEPTABLE MANUFACTURERS

- A. Southwire Company
- B. Belden Division, Cooper Industries, Inc.
- C. Okonite Company
- D. Cablec Continental Cables Company
- E. General Cable Company
- F. Superior Essex

2.02 MATERIALS AND EQUIPMENT

- A. Design. Provide cable with the following design characteristics. The cable shall consist of multiple conductors. The cable assembly shall be UL listed, flame, oil and sunlight resistant, and certified for continuous operation at the temperature specified on the 600-Volt Control Cable Data Sheets in wet or dry locations while installed in underground duct, conduit, or cable tray. The number and size of conductors supplied in each cable shall correspond to the quantities specified on the 600-Volt Control Cable Data Sheets.
- B. Conductors. Provide conductors which are concentric or bunch-stranded, annealed tinned copper with physical and electrical properties conforming to ASTM B 3, ASTM B 8 or ASTM B 33 or ASTM B 174 and Part 3 of ICEA S-61-402, S-66-524, or S-68-516 unless otherwise specified on the 600-Volt Control Cable Data Sheets.
- C. Insulation. Each conductor shall be insulated as specified on the 600-Volt Control Cable Data Sheets complying to the requirements of Part 3 of ICEA S-61-402, S-66-524 or S-68-516. The average insulation thickness shall not be less than the dimensions shown in Section 3.2, Table 3-1 of ICEA S-61-402, S-66-524 or S-68-516 for 600 volt insulation unless otherwise specified on the 600-Volt Control Cable Data Sheets. The minimum insulation thickness shall not be less than 90 percent of the value given in the table.
- D. Drain Wire. Provide drain wire Class B, seven-stranded, tin-coated copper in accordance with ASTM B 3, ASTM B 8, or ASTM B 33 and as specified on the 600-Volt Control Cable Data Sheets.

600-VOLT CONTROL CABLE

- E. Shielding. Cable shielding shall consist of laminated, nonburning, mylar-backed aluminum tape applied helically around conductors with the aluminum side in continuous contact with the drain wire unless otherwise specified on the 600-Volt Control Cable Data Sheet. The tape shall be wrapped around the conductors with a 25 percent minimum overlap unless otherwise specified on the 600-Volt Control Cable Data Sheets.

- F. Jacket.
 - 1. When control cables are to be enclosed in conduit, ducts or in other raceway systems, the cables shall be of the non-metallic type and shall be covered by an overall nonmetallic jacket, as specified on the 600-Volt Control Cable Data Sheets, which complies with the requirements of Section 4.4 of ICEA S-66-524 or S-68-516, Section 4.3 of ICEA S-61-402, or Table 21-5 of Part 21 of UL 83.

 - 2. Multi-conductor cables shall have a jacket thickness which complies with Table 4-7 of Part 4 of ICEA S-66-524, Table 4-5 of Part 4 of ICEA S-68-524, or Table 4-6 of Part 4 of ICEA S-61-402 unless otherwise specified on the 600-Volt Control Cable Data Sheets.

- G. Armor. Where control cables are to be exposed, as in cable tray, cable channel or other cable support systems, the cables shall be protected by an interlocked metal tape armor made of galvanized steel which meets the requirements of paragraph 4.5 of ICEA S-68-516 or S-66-524 unless otherwise specified on the 600-Volt Control Cable Data Sheets. An over-all jacket shall be provided as specified in the Data Sheets.

- H. Conductor Identification. Identify individual conductors by method as specified on the 600-Volt Control Cable Data Sheets in conformance with Appendix L of ICEA S-66-524, Part 5 of ICEA S-68-516, or Appendix I of ICEA S-61-402.

- I. Cable Marking. Print cable marking information on the jacket of each cable at 2-foot intervals. Use a permanent printing method with a color sharply contrasting the jacket color. See the 600-Volt Control Cable Data Sheets for the minimum information required.

PART 3 EXECUTION

3.01 PREPARATION

- A. When control wiring requires installation in cable tray and other cable support systems, use the 600-Volt Multiconductor Control Cable.
- B. Complete cable raceway systems, underground duct banks, and cable support systems before installing cables.
- C. Verify sizing of raceways and pullboxes to ensure proper accommodation for the cables.
- D. Check the length of the cable raceway system against the length of cable on the selected reel.
- E. Do not install or work on PVC insulated or jacketed cables in temperatures below 32 F.
- F. Clean conduits of all foreign matter before cables are pulled in.
- G. Provide at least 30 percent spare conductors.

3.02 INSTALLATION

- A. Cable in Conduit and Ductbank.
 - 1. Install cables in accordance with the manufacturer's instructions and the National Electrical Code (NEC), Article 725 - Class 1, Class 2, and Class 3 Remote Control, Signaling and Power Limited Circuits. Do not exceed maximum wire tension, maximum insulation pressure and minimum bending radius.
 - 2. Pull cables into conduits using wire pulling compounds approved by cable manufacturers to reduce friction. Lubricants must not be harmful to the conductor insulation or cable jacket. Mixtures containing soap or detergent shall not be used.
- B. Cable in Tray
 - 1. Install armored cable in cable tray.
 - 2. 600-Volt Tray rated Control Cable may be installed in cable tray with 600-volt Tray rated power cables.
 - 3. Install cables in trays in a neat and orderly manner. Tie cables to the rungs at approximate 15-foot intervals by use of cable ties.
- C. Termination

600-VOLT CONTROL CABLE

1. Do not splice conductors unless approved by the Project Manager. For termination use crimp-on type, ring tongue, non-insulated, tin-plated copper lugs.
2. Mark wiring on both ends with circuit numbers or loop tag numbers. Heat shrink wire markers after the ring tongue terminal has been installed. Extend the marker over the crimp-on base of the terminal.

D. Tests

1. Test insulation integrity and conductor continuity before connecting the cables.
2. Use a 500 VDC megohmmeter and perform the cable insulation test in accordance with the operating instructions.

E. Termination. After the 600-volt control cable has been tested with satisfactory results, terminate the cable at both ends to designated terminal points.

END OF SECTION

DATA SHEET 1 of 3
IDENTIFICATION

1. _____
2. CLIENT _____ MANUFACTURER _____
3. PROJECT _____ MODEL NO. _____
4. JOB NO. _____ SIZE _____
5. PLANT LOCATION _____ SERIAL NO. _____
6. ITEM NO. _____ INQUIRY NO _____
7. SERVICE _____ P.O. NO. _____
8. NO. ITEMS REQUIRED _____
9. _____

10. NOTE: [] INDICATES INFORMATION TO BE COMPLETED BY MANUFACTURER

OPERATING DATA

11. _____
12. VOLTAGE _____ FREQUENCY _____ AMBIENT TEMP (°C) _____
13. INSTALLATION ENVIRONMENT _____
14. _____
15. _____

CONSTRUCTION
CONDUCTORS

16. _____
17. _____
18. SIZE (AWG or KCMIL): _____
19. ARRANGEMENT: _____ SINGLE CONDUCTOR ___ OTHER _____
20. _____ MULTI-CONDUCTOR _____ NO. OF CONDUCTORS _____
21. MATERIAL: _____ BARE COPPER _____ TIN-COATED COPPER _____
22. _____ SOLID _____ STRANDED _____
23. SINGLE CONDUCTOR: _____ JACKETED _____ NON-JACKETED _____
24. MULTI-CONDUCTOR _____ JACKETED _____ NON-JACKETED (TRIPLEXED ONLY) _____
25. _____ ARMORED _____ ARMORED W/OUTER JACKET _____
26. _____ GROUND WIRES IN INTERSTICES: _____ COPPER _____ ALUMINUM _____
27. _____ CONDUCTOR CLASS PER _____ ASTM STANDARD _____
28. SPECIAL REQUIREMENTS: _____
29. _____

INSULATION

30. _____
31. TYPE: _____ CROSS LINKED POLYETHYLENE _____ CHLOROSULFONATED POLYETHYLENE _____
32. _____ POLYVINYL CHLORIDE _____ ETHYLENE-PROPYLENE RUBBER _____
33. _____ POLYETHYLENE _____ OTHER _____
34. THICKNESS (MILS OR MM) _____
35. COLOR: _____
36. TEMPERATURE RATING: _____ 60°C - 75°C (WET-DRY) _____ 75°C - 90°C (WET-DRY) _____
37. _____ 90°C (WET-DRY) _____ OTHER _____
38. DRAIN WIRE: SIZE _____ STRANDED ___ SOLID ___ BARE COPPER _____ TIN-COATED COPPER _____
39. SPECIAL REQUIREMENTS: _____
40. _____
41. _____

SHIELDING

42. _____
43. TYPE SHIELDING: _____ BRAIDED _____ CONDUCTIVE PLASTIC _____
44. _____ CONDUCTIVE COTTON _____ SPIRAL-SERVED _____ CORRUGATED _____
45. _____ MYLAR FILM - ALUMINUM FOIL _____ POLYESTER FILM-ALUMINUM FOIL _____
46. _____ COPPER TAPE _____ OTHER _____
47. POLYESTER FILM-ALUMINUM LOCATION _____ INSIDE _____ OUTSIDE _____
48. _____ PAIR SHIELD ISOLATED _____
49. _____ SEPARATOR _____ FILLED _____
50. _____
ITEM NO. _____

600-VOLT CONTROL CABLE

11th Street Facility Odor Control
WBS No.: R-000020-0010-3

**DATA SHEET 2 of 3
SHIELD COMBINATION**

1. _____
 2. OVERSHIELD: _____ POLYESTER FILM ALUMINUM _____
 3. _____ BRAID _____ SERVED _____ OTHER _____
 4. _____
 5. BRAID SHIELD: _____ TYPE STRANDS _____ % COVERAGE _____ TINNED
 6. _____ BARE _____ COPPER _____ ALUMINUM
 7. _____ OTHER _____
 8. _____
 9. OVERALL TYPE: _____ POLYESTER _____ PAPER OTHER: _____
 10. _____
 11. _____

JACKET

12. _____
 13. TYPE: _____ POLYVINYL CHLORIDE _____ POLYETHYLENE
 14. _____ HEAVY DUTY NEOPRENE _____ CHLOROSULFONATED POLYETHYLENE
 15. _____ NYLON _____ OTHER _____
 16. _____
 17. THICKNESS (MILS OR MM) _____
 18. COLOR: _____ BLACK _____ OTHER _____
 19. SPECIAL REQUIREMENTS: _____
 20. _____
 21. _____

ARMORING

22. _____
 23. TYPE: _____ INTERLOCKED (POSITIVE) _____ OTHER _____
 24. MATERIAL: _____ GALVANIZED STEEL _____ ALUMINUM
 25. _____ OTHER _____
 26. COVERING: _____ POLYVINYL CHLORIDE _____ OTHER _____
 27. COLOR: _____ BLACK _____ OTHER _____
 28. SPECIAL REQUIREMENTS: _____
 29. _____
 30. _____

MARKING

CONDUCTOR IDENTIFICATION

31. _____
 32. SINGLE CONDUCTOR: _____
 33. MULTI-CONDUCTOR: _____
 34. _____

CABLE MARKING

35. _____
 36. REQUIRED: _____ MANUFACTURER _____ CONDUCTOR SIZE
 37. _____ NO. OF CONDUCTORS _____ VOLTAGE RATING
 38. _____ UL LABEL _____ NEC TYPE
 39. _____ TEMPERATURE RATING _____ MONTH/YEAR OF MANUFACTURE
 40. _____ INSULATION _____ FOOTAGE MARKERS
 41. _____ OTHER _____
 42. _____

FACTORY TESTING/DOCUMENTATION

43. _____
 44. _____ PHYSICAL _____ FLAME TESTS (PER IEEE 383 - 2.5)
 45. _____
 46. _____ ELECTRICAL _____ OTHER TESTS _____
 47. _____ MEGGER _____
 48. _____ OTHER _____
 49. _____
 50. _____

ITEM NO. _____

DATA SHEET 3 of 3
QUALITY ASSURANCE

1. _____
2. _____ NO ADDITIONAL REQUIREMENTS _____ ATTACHED SPECIFICATION _____
3. _____

PACKAGING

4. _____
5. _____ DOMESTIC _____ EXPORT _____
6. _____

SHIPPING

7. _____
8. REEL TYPE: _____ RETURNABLE _ NON-RETURNABLE _____ LENGTH PER REEL _____
9. _____

10. ADDITIONAL REQUIREMENTS: _____
11. _____
12. _____
13. _____
14. _____

MANUFACTURER DATA

15. _____
16. CABLE DIMENSION (O.D. IN.) _____ SHIPPING TIME _____
17. CABLE CROSS-SECTIONAL AREA _____ OTHER _____
18. CABLE WEIGHT (LBS/FT) _____
19. CABLE MIN BENDING RADIUS _____
20. TENSILE STRENGTH _____
21. GROSS WEIGHT/REEL (LBS) _____
22. TOTAL CUBIC FEET/REEL _____
23. SHORT CIRCUIT WITHSTAND CURVES _____
24. CABLE TESTING REQUIREMENTS _____
25. _____

NOTES

26. _____
27. _____
28. _____
29. _____
30. _____
31. _____
32. _____
33. _____
34. _____
35. _____
36. _____
37. _____
38. _____
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Section 16122

600-VOLT POWER CABLE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. 600-volt power cable.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM).
 - 1. ASTM B 3: Soft or Annealed Copper Wires.
 - 2. ASTM B 8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft.
 - 3. ASTM B 33: Tinned Soft or Annealed Copper Wire for Electrical Purposes.
- B. Institute of Electrical and Electronics Engineers (IEEE), IEEE 383-2.5: IEEE Standard for Type Test of Class IE Electric Cables and Field Splices.
- C. Insulated Cable Engineers Association (ICEA).
 - 1. ICEA S-61-402: Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-5).
 - 2. ICEA S-66-524: Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-7).
 - 3. ICEA S-68-516: Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-8).
- D. Underwriters' Laboratories (UL).
 - 1. UL 44: Rubber Insulated Wires and Cables.
 - 2. UL 83: Thermoplastic Insulated Wire and Cables.

600-VOLT POWER CABLE

- E. National Fire Protection Association (NFPA), No. 70 - National Electrical Code (NEC), Chapter No.3 - Wiring Methods and Materials.
- F. City of Houston Electrical Code.

1.03 SUBMITTALS

- A. Make submittals following Section 01330 - Submittal Procedures:
 - 1. Completed engineer's data sheets
 - 2. Completed manufacturer's data sheets
 - 3. Manufacturer's cut sheets, catalog data
 - 4. Installation, terminating and splicing procedure
 - 5. Instruction for handling and storage
 - 6. Dimensions and weight
 - 7. Conformance certificate.

1.04 QUALITY ASSURANCE

- A. Tests.
 - 1. Cable shall be tested at the factory to confirm that the cable complies with requirements of Part 6 of ICEA S-61-402, S-66-524 or S-68-516. Refer to data sheet for additional test requirements.
 - 2. Where applicable, the cable shall meet the requirements of the vertical tray flame test as described in IEEE 383-2.5.

1.05 DELIVERY STORAGE AND HANDLING

- A. Ship cable on manufacturer's standard reel sizes unless otherwise specified. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable. Reels shall be of the type specified on the data sheets. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel. Provide moisture protection by manufacturer's standard procedure or heat shrinkable self-sealing end caps applied to both ends of the cable.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Southwire company
- B. Superior Essex
- C. General Cable Company
- D. Okonite Company
- E. Pirelli Cable Corporation
- F. Rome Cable Corporation
- G. Triangle Wire and Cable, Inc.

2.02 MATERIALS AND EQUIPMENT

- A. Design. Provide cable with the following design characteristic. Cable shall be UL 44 or UL 83 listed, rated 600 volts and certified for continuous operation at the temperature as specified on the 600 Volt Power Cable Data Sheets while installed in underground duct, conduit, or cable tray. Cables shall be single-conductor or multi-conductor (with ground) as specified on the data sheets.
- B. Conductors. Provide conductors which are Class B, concentric stranded, annealed copper coated, unless otherwise specified on the data sheets, with physical and electrical properties conforming to ASTM B 3, ASTM B 8 or ASTM B 33 and Part 2 of ICEA S-61-402, S-66-524, or S-68-516. The number and size of conductors supplied in each cable shall correspond to the quantities specified on the data sheets.
- C. Insulation. Insulate each conductor as specified on the 600 Volt Power Cable Data Sheets to meet the requirements of Part 3 of ICEA S-61-402, S-66-524 or S-68-516. The insulation thickness shall match the dimensions listed in Section 3.2, Table 3-1 of ICEA S-61-402, S-66-524 or S-68-516, as specified on the data sheets.
- D. Jacket.

600-VOLT POWER CABLE

1. When power cables are to be enclosed in conduit, ducts or in other raceway systems, multiconductor power cables shall be of the non-metallic type and shall be covered by an overall nonmetallic jacket as specified on the Data Sheets, which complies with the requirements of Section 4.4 of ICEA S-66-524 or S-68-516, Section 4.3 of ICEA S-61-402, or Table 21-5 of Part 21 of UL 83.
 2. Single-conductor cables shall have a jacket thickness which meets the requirements of Table 4-4 of Part 4 of ICEA S-66-524, Table 4-2 of Part 4 of ICEA S-68-516, or Table 4-2 or 4-6 of Part 4 of ICEA S-61-402. Multi-conductor cables shall have a jacket thickness which complies with Table 4-7 of Part 4 of ICEA S-66-524, Table 4-2 of Part 4 of ICEA S-68-516, Table 4-5 of Part 4 of ICEA S-68-516, or Table 4-6 of Part 4 of ICEA S-61-402, unless otherwise specified on the data sheets.
- E. **Armor.** When power cables are to be exposed in a cable tray, cable channel or other cable support systems, the multiconductor power cables shall be protected by an interlocked metal armor made of galvanized steel which meets the requirements of paragraph 4.5 of ICEA S-68-516 or S-66-524 unless otherwise specified on the data sheets. An over-all jacket shall be provided as specified in the data sheets.
- F. **Cable Marking.** Print cable marking information on the overall cable jacket at 2-foot intervals. Use a permanent printing method and color sharply contrasting with the jacket color. Identify individual conductors as specified on the data sheets in conformance with Part 5 of ICEA S-61-402, S-66-524, and S-68-516.

PART 3 EXECUTION**3.01 PREPARATION**

- A. Complete cable raceway systems, underground duct banks, and cable support systems before installing cables.
- B. Verify sizing of raceways and pullboxes to ensure proper accommodation for the cables.
- C. Check the length of the cable raceway system against the length of cable on the selected reel.
- D. Do not install or work on PVC insulated or jacketed cables in temperatures below 32 F.

3.02 INSTALLATION

- A. Cable in Conduit and Ductbank.
 - 1. Clean conduits of foreign matter before cables are pulled.
 - 2. Install cables in accordance with the manufacturer's instructions and the National Electrical Code (NEC), Chapter 3 - Wiring Methods and Materials. Do not exceed maximum wire tension, maximum insulation pressure and minimum bending radius.
 - 3. Pull cables into conduits using wire pulling compounds approved by cable manufacturers to reduce friction. Lubricants must not be harmful to the conductor insulation. Mixtures containing soap or detergent shall not be used.

- B. Cable in Tray.
 - 1. Install medium voltage (5 kv and 15 kv) and 600V cables in separate trays or separated cables by a barrier in a single tray in accordance with NEC 392.
 - 2. Install cables in trays in a neat and orderly manner. Tie cables to the tray rungs at approximate 15-foot intervals by use of cable ties.
 - 3. The number of multi conductors or cables rated 2000 volts or less shall be according to NEC 392.22.
 - 4. Using cable ties, make a triplex of single conductors used for 3-phase systems. Install in cable tray in accordance with NEC 392.20(D).

- C. Preparation for Termination.
 - 1. Make up 600-volt power cable terminations and splices with heat shrinkable sleeves and seals.
 - 2. Use crimp-on terminal lugs and connectors for all sizes of conductors.
 - 3. Use crimp-on lugs with long barrel and 2-hole tongues, except in places where terminations space is limited.

- D. Tests.
 - 1. Before connecting the cables, test insulation integrity.

600-VOLT POWER CABLE

2. Use a 500 VDC megohmmeter and perform the cable insulation test in accordance with the operating instructions.

E. Termination.

1. After the 600-volt cable has been tested with satisfactory results, terminate the cable at both ends to designated terminal points.
2. Tighten connection bolts with a torque wrench to specified torque levels.

END OF SECTION

DATA SHEET 1 of 3
IDENTIFICATION

1. CLIENT _____ MANUFACTURER _____
2. PROJECT _____ MODEL NO. _____
3. JOB NO. _____ SIZE _____
4. PLANT LOCATION _____ SERIAL NO. _____
5. ITEM NO. _____ INQUIRY NO. _____
6. SERVICE _____ P.O. NO. _____
7. QUANTITY REQUIRED _____
8. _____
9. _____

OPERATING DATA

10. VOLTAGE _____ FREQUENCY _____ AMBIENT TEMP (°C) _____
11. INSTALLATION ENVIRONMENT _____
12. _____
13. _____

CONSTRUCTION
CONDUCTORS

14. SIZE (AWG or MCM): _____
15. ARRANGEMENT: _____ SINGLE CONDUCTOR OTHER _____
16. _____ MULTI-CONDUCTOR _____ NO. OF CONDUCTORS _____
17. MATERIAL: _____ COPPER _____ ALUMINUM _____ TINNED COPPER
18. _____ JACKETED _____ NON-JACKETED _____
19. _____ GROUND WIRES IN INTERSTICES: _____ COPPER _____ ALUMINUM
20. ASTM STANDARD: _____
21. SPECIAL REQUIREMENTS: _____
22. _____
23. _____

INSULATION

24. TYPE: _____ CROSS-LINKED-THERMOSETTING-POLYETHYLENE _____ CHLOROSULFONATED POLYETHYLENE
25. _____ POLYVINYL CHLORIDE _____ ETHYLENE-PROPYLENE RUBBER
26. _____ POLYETHYLENE _____ OTHER _____
27. COLOR: _____
28. TEMPERATURE RATING: _____ 60°C - 75°C (WET-DRY) _____ 75°C - 90°C (WET-DRY)
29. _____ 90°C (WET-DRY) _____ OTHER _____
30. INSULATING RATING: _____ 100% _____ 133% _____ 173% _____ OTHER _____
31. ICEA STANDARD: _____
32. SPECIAL REQUIREMENTS: _____
33. _____
34. _____

JACKET

35. TYPE: _____ POLYVINYL CHLORIDE _____ POLYETHYLENE
36. _____ HEAVY DUTY NEOPRENE _____ CHLOROSULFONATED POLYETHYLENE
37. _____ NYLON _____ OTHER: _____
38. COLOR: _____ BLACK _____ OTHER: _____
39. ICEA STANDARD: _____
40. SPECIAL REQUIREMENTS: _____
41. _____
42. _____

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600-VOLT POWER CABLE

DATA SHEET 2 of 3

ARMORING

1. _____
2. TYPE: _____ INTERLOCKED (POSITIVE) _____ OTHER _____
3. MATERIAL: _____ GALVANIZED STEEL _____ ALUMINUM _____
4. _____ OTHER _____
5. COVERING: _____ POLYVINYL CHLORIDE _____ OTHER _____
6. COLOR: _____ BLACK _____ OTHER _____
7. ICEA STANDARD: _____
8. SPECIAL REQUIREMENTS: _____
9. _____

MARKING

CONDUCTOR IDENTIFICATION

10. _____
11. _____
12. SINGLE CONDUCTOR: _____
13. MULTI-CONDUCTOR: _____

CABLE MARKING

14. _____
15. REQUIRED: _____ MANUFACTURER _____ CONDUCTOR SIZE _____
16. _____ NO. OF CONDUCTORS _____ VOLTAGE RATING _____
17. _____ UL LABEL _____ NEC TYPE _____
18. _____ TEMPERATURE RATING _____ MONTH/YEAR MANUFACTURE _____
19. _____ OTHER _____
20. _____

TESTING

21. _____
22. _____ PHYSICAL _____ FLAME TESTS (PER IEEE 383 - 2.5) _____
23. _____
24. _____ ELECTRICAL _____ OTHER TESTS _____
25. _____ MEGGER _____
26. _____ OTHER _____
27. _____
28. _____
29. _____

QUALITY ASSURANCE

30. _____
31. _____ NO ADDITIONAL REQUIREMENTS _____ ATTACHED SPECIFICATION _____
32. _____

PACKAGING

33. _____
34. _____ DOMESTIC _____ EXPORT _____
35. _____

SHIPPING

36. _____
37. REEL TYPE: _____ RETURNABLE _____ NON-RETURNABLE _____ LENGTH PER REEL _____
38. _____
39. _____
40. _____
41. _____

42. ADDITIONAL REQUIREMENTS: _____
43. _____
44. _____
45. _____
46. _____
47. _____
48. _____
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50. _____

ITEM NO. _____

DATA SHEET 3 of 3
MANUFACTURER DATA

1.	_____	_____
2.	CABLE DIMENSION (O.D. IN.) _____	SHIPPING TIME _____
3.	CABLE CROSS-SECTIONAL AREA _____	OTHER _____
4.	CABLE WEIGHT (LBS/FT) _____	_____
5.	CABLE MIN BENDING RADIUS _____	_____
6.	TENSILE STRENGTH _____	_____
7.	GROSS WEIGHT/REEL (LBS) _____	_____
8.	TOTAL CUBIC FEET/REEL _____	_____
9.	SHORT CIRCUIT WITHSTAND CURVES _____	_____

NOTES

10. _____

11. _____

12. _____

13. _____

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Section 16125

THERMOCOUPLE EXTENSION CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specifications for thermocouple extension cable.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM).
 - 1. ASTM B3: Specification for Soft or Annealed Copper Wire.
 - 2. ASTM B8: Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft.
 - 3. ASTM B33: Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.
- B. American National Standards Institute (ANSI), ANSI MC96.1: Temperature Measurement Thermocouples.
- C. Institute of Electrical and Electronics Engineers (IEEE), IEEE 383-2.5: IEEE Standard for Type Test of Class IE Electric Cables and Field Splices.
- D. Insulated Cable Engineers Association (ICEA).
 - 1. ICEA S-61-402: Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-5).
 - 2. ICEA S-66-524: Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-5).
 - 3. ICEA S-68-516: Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-8).
 - 4. American National Standards Institute/National Fire Protection NEC), Article 725, Class 1, Class 2, and Class 3 Remote-Controls, (Signaling, and Power-Limited Circuits).

THERMOCOUPLE EXTENSION CABLE

5. Underwriters' Laboratories (UL), UL Subject 13: Listing Mark and Follow-up Inspection.

1.03 SUBMITTALS

A. Submit under the provisions of Section 01330 the following:

1. Completed engineer's data sheets from this specification or manufacturer's data sheets, cut sheets and catalog data.
2. Installation, terminating and splicing procedure (including bend radius and pulling tension data).
3. Instruction for handling and storage.
4. Dimensions and weight.

1.04 QUALITY ASSURANCE

A. Tests.

1. Cable shall be tested at the factory to confirm that the cable complies with requirements of this specification. Perform manufacturer's standard test and those listed in UL Subject 13.
2. Perform any additional tests specified on the Thermocouple Extension Cable Data Sheets.
3. Where applicable, the cable shall meet the requirements of the vertical tray flame test as described in IEEE 383-2.5.
4. Manufacturer shall perform any additional test and inspection required to ensure that cable meets requirements specified on the Thermocouple Extension Cable Data Sheets.

1.05 DELIVERY, STORAGE AND HANDLING

A. Ship cable on manufacturer's standard reel sizes unless otherwise specified. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable. Reels shall be of the type specified on the data sheets. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel. Provide moisture protection by manufacturer's standard procedure or heat shrinkable self-sealing end caps applied to both ends of the cable.

PART 2 P R O D U C T S

2.01 ACCEPTABLE MANUFACTURERS

- A. Alpha Wire Corporation
- B. Belden Div., Cooper Industries, Inc.
- C. Cablec Continental Cables Company
- D. General Cable Company
- E. Manhattan Electric Cable Corporation
- F. Okonite Company

2.02 MATERIALS AND EQUIPMENT

- A. Design. Provide cable with the following design characteristics. Cable is used to connect field-mounted thermocouples to temperature monitoring and recording devices. The cable assembly shall consist of individually insulated conductors covered by an overall jacket. The cable is intended for circuits in accordance with Article 725 of the National Electric Code and the Thermocouple Extension Cable Data Sheets. Install thermocouple extension cable in underground duct, conduit, or cable tray. The type of conductors, the number of pairs, and other requirements of each cable shall be specified on the Thermocouple Extension Cable Data Sheets.
- B. Construction. Provide conductors made from metals matching the characteristics of the thermocouple and with wire size as specified on the Thermocouple Extension Cable Data Sheets. Select conductor with a calibrated tolerance which is within the standard or special limits of error defined in ANSI MC96.1 and as specified on the Thermocouple Extension Cable Data Sheets.
- C. Insulation. The primary insulation of each conductor is specified on the Thermocouple Extension Cable Data Sheets. The physical and electrical properties of the insulation shall comply with the requirements of UL Subject 13.
- D. Drain Wire. Provide drain wire which is Class B, seven-stranded or solid; and bare or tin-coated copper in accordance with ASTM B3, B8 or B33, and as specified on the Thermocouple Extension Cable Data Sheets.
- E. Shielding. Provide shielding consisting of laminated, nonburning, mylar-backed aluminum tape applied helically around a twisted pair of

THERMOCOUPLE EXTENSION CABLE

conductors with the aluminum side in continuous contact with the drain wire unless otherwise specified on the Thermocouple Extension Cable Data Sheets.

- F. Wrap the tape around the conductors with a 25 percent minimum overlap unless otherwise specified on the Thermocouple Extension Cable Data Sheets.
- G. Jacket. The jacket used to cover single and multi-pair cables is specified on the Thermocouple Extension Cable Data Sheets. The physical and electrical properties of the jacket shall comply with the applicable requirements of UL Subject 13. The jacket thickness shall match the dimensions shown in Table 10 of UL Subject 13.
- H. Single Pair Cables. Each pair shall consist of two individually insulated conductors with a drain wire, wrapped by a shield and covered by an overall jacket as specified on the Thermocouple Extension Cable Data Sheets.
- I. Multi-Pair Cables. Multi-pair cables shall consist of the required number of electrically isolated, shielded, twisted, insulated pairs which are bundled together and covered by an overall shield and jacket as specified on the Thermocouple Extension Cable Data Sheets.
- J. Armor or Barrier. Where requested, use thermocouple extension cables protected by an interlocked metal tape armor coating made of galvanized steel, which meets the requirements of paragraph 4.5 of ICEA S-68-516 or S-66-524 unless otherwise specified on the Thermocouple Extension Cable Data Sheets.
- K. Conductor Identification. Use individual conductors in each cable which are color coded in accordance with Table 6 of ANSI MC96.1, and as specified on the Thermocouple Extension Cable Data Sheets.
- L. Cable Marking. Print cable marking information on the jacket of each cable at 2-foot intervals. Use a permanent printing method with a color sharply contrasting the jacket color. See the Thermocouple Extension Cable Data Sheets for the minimum information required.

PART 3 EXECUTION

3.01 PREPARATION

- 3.02 Complete cable raceway systems, underground duct banks and cable support systems before installing cables.

- A. Verify sizing of raceways and pullboxes to ensure proper accommodation for the cables.
- B. Check the length of the cable raceway system against the length of cable on the selected reel.
- C. Do not install or work on PVC insulated or jacketed cables in temperatures below 32 degrees F.
- D. Clean conduits of foreign matter before cables are pulled.

3.03 INSTALLATION

- A. Cable in Conduit and Duct Bank
 - 1. Install cables in accordance with the manufacturer's instructions and NEC Article 725 - Class 1, Class 2, and Class 3 Remote-Control, Signaling and Power-Limited Circuit. Do not exceed maximum wire tension, maximum insulation pressure and minimum bending radius.
 - 2. Pull cables into conduits using adequate lubrication to reduce friction. Lubricants must not be harmful to the conductor insulation.
 - 3. Conduits carrying low level signal cables shall be PVC-coated rigid steel.
 - 4. Use thermocouple leads that are continuous from instrument to thermocouple. Do not splice extension cable. Where junctions are unavoidable, make connections only on terminal blocks enclosed in suitable boxes. Generally, use such boxes only in installation involving a large number of thermocouples where multiconductor cable is applicable. Take care in locating such boxes in areas that have comparatively stable ambient temperature conditions. Avoid hot locations.
 - 5. Do not install thermocouple leads in the same conduit or pull box with any other wiring.
 - 6. Make the connection between thermocouple lead and rigid conduit by running cable in a flexible conduit forming a drip loop to prevent excessive moisture from entering the conduit system.
- B. Cable in Tray. Install thermocouple extension cable in cable tray only when the tray is dedicated for this type cables and cables are approved for tray installation.

THERMOCOUPLE EXTENSION CABLE

C. Termination

1. Do not splice conductors.
2. For shielded thermocouple cable, terminate the shield and ground it at one end only, preferably at the control panel end.
3. If splicing is required, maintain shield continuity by jumpering the ground shield across connection point where it is broken at junction boxes, or other splice points. Insulate these points from ground.
4. Mark wiring on both ends with circuit numbers or loop tag numbers. Heat shrink wire markers after the ring or fork terminal has been installed. Extend the marker over the crimp or base of the terminal.

END OF SECTION

THERMOCOUPLE EXTENSION CABLE

**DATA SHEET 1 of 4
IDENTIFICATION**

1) _____
2) CLIENT _____ MANUFACTURER _____
3) PROJECT _____ MODEL NO. _____
4) JOB NO. _____ SIZE _____
5) PLANT/LOCATION _____ SERIAL NO. _____
6) ITEM NO. _____ INQUIRY NO. _____
7) SERVICE _____ P.O. NO. _____
8) QUANTITY REQUIRED _____
9) _____

10) NOTE: [] INDICATES INFORMATION TO BE COMPLETED BY SELLER

ENVIRONMENTAL CONDITIONS

13) TEMPERATURE RANGE: MAX _____ °C MIN _____ °C
14) INSTALLATION: _____ ENCLOSED _____ OUTDOORS _____ INDOORS
15) _____ UNDERGROUND _____ UNDERWATER _____
16) EXPOSURE: _____ MOISTURE _____ DIRT _____ OZONE
17) _____ RADIATION _____ CHEMICALS:(PLEASE LIST) _____
18) _____
19) SOILS: (PLEASE LIST) _____ ELECTROSTATIC INTERFERENCE _____
20) ELECTROMAGNETIC INTERFERENCE DISTURBANCES _____ RODENTS _____
21) OTHER: _____
22) _____
23) _____

PHYSICAL REQUIREMENTS

26) FLEXIBILITY: _____ VERY FLEXIBLE _____ FLEXIBLE _____ NOT CRITICAL
27) RESISTANCE TO: _____ ABRASION _____ IMPACT _____ CRUSH
28) _____ DEFORMATION _____ CUT THROUGH _____ COLD FLOW
29) TERMINATION METHOD: _____
30) _____
31) ADDITIONAL REQUIREMENTS: _____
32) _____
33) _____
34) _____

ELECTRICAL REQUIREMENTS

36) _____ CROSS TALK (ISOLATION IN DB AT FREQ)
37) _____ DC RESISTANCE (OHMS/1000 FT)
38) _____ VOLTAGE BREAKDOWN (VOLTS/MILL)
39) _____ INSULATION RESISTANCE (MEGOHMS/1000 FT)
40) ADDITIONAL REQUIREMENTS: _____
41) _____
42) _____
43) _____
44) _____ CLASS I _____ CLASS II _____ CLASS III
45) _____ 600 VOLT _____ 150 VOLT _____ 300 VOLT

46) ADDITIONAL REQUIREMENTS: _____
47) _____
48) _____
49) _____
50) _____

THERMOCOUPLE EXTENSION CABLE

DATA SHEET 2 of 4

TYPE

1) _____
 2) DESIGN TEMPERATURE SCALE: _____ CELSIUS _____ FAHRENHEIT
 3) _____ JX _____ KX _____ TX _____ EX
 4) _____ SX _____ RX _____ BX
 5) _____ OTHER _____
 6) _____
 7) _____

CONSTRUCTION

CONDUCTORS

10) SIZE (AWG): _____
 11) _____ COPPER _____ STRANDED _____ SOLID
 12) _____ LIMITS OF ERROR _____
 13) _____
 14) _____
 15) ADDITIONAL REQUIREMENTS: _____
 16) _____
 17) _____

INSULATION

19) RUBBER: _____ SBR _____ NATURAL _____ SYNTHETIC _____ BUTYL _____ POLYBUTADIENE
 20) _____ NEOPRENE _____ NBR _____ EPR/EPT _____ CHLOROSULFONATED POLYETHYLENE _____ SILICONE
 21) PLASTIC: _____ PVC _____ LOW-DENSITY POLYETHYLENE _____ CELLULAR POLYETHYLENE
 22) _____ TEFLON
 23) _____ HIGH-DENSITY POLYETHYLENE _____ POLYPROPYLENE _____ POLYURETHANE
 24) _____ NYLON _____ OTHER: _____
 25) VOLTAGE RATING: _____ AC _____ DC WALLTHICKNESS _____
 26) NUMBER OF CONDUCTORS: _____ NUMBER OF PAIRS: _____
 27) _____ NUMBER OF TRIADS: _____
 28) LAY LENGTH PER INCH OF PAIRS: _____ LAY _____ TWIST-COATED
 29) DRAIN WIRE: _____ SIZE _____ STRANDED _____ SOLID _____ BARE COPPER _____ TIN-COATED COPPER
 30) COLOR _____
 31) TEMPERATURE RATING: _____ 60° - 75°C (WET-DRY) _____ 75°C - 90°C (WET-DRY)
 32) _____ 90°C (WET-DRY) _____ 105°C
 33) OTHER: _____
 34) _____
 35) _____

SPECIAL REQUIREMENTS: _____

SHIELDING

40) TYPE SHIELDING: _____ BRAIDED _____ CONDUCTIVE PLASTIC
 41) _____ CONDUCTIVE COTTON _____ SPIRAL-SERVED
 42) _____ MYLAR FILM-ALUMINUM FOIL _____ POLYESTER FILM-ALUMINUM FOIL
 43) _____ OTHER: _____
 44) POLYESTER FILM-ALUMINUM LOCATION _____ INSIDE _____ OUTSIDE _____ PAIR SHIELD ISOLATED
 45) _____ SEPARATOR _____ FILTER
 46) _____

SHIELD COMBINATION

48) OVERSHIELD: _____ POLYESTER FILM-ALUMINUM
 49) _____ BRAID _____ SERVED
 50) _____ OTHER: _____

THERMOCOUPLE EXTENSION CABLE

DATA SHEET 3 of 4

SHIELD COMBINATION (CONT)

1) _____
2) BRAID SHIELD: _____ TYPE STRANDS _____ % COVERAGE _____ TINNED
3) _____ BARE _____ COPPER _____ ALUMINUM
4) OVERALL TYPE: _____ POLYESTER _____ PAPER _____ OTHER: _____
5) _____
6) SHIELD OVERLAP _____ %
7) _____
8) _____

JACKET

9) _____
10) TYPE: _____ POLYVINYL CHLORIDE _____ POLYETHYLENE
11) _____ HEAVY DUTY NEOPRENE _____ CHLOROSULFONATED POLYETHYLENE
12) _____ KAPTON _____ TEFLON
13) _____ NYLON _____ OTHER: _____
14) _____
15) _____
16) THICKNESS (MILS OR MM) _____
17) COLOR: _____ BLACK _____ OTHER: _____
18) SPECIAL REQUIREMENTS: _____
19) _____
20) _____

ARMOR OR BARRIER

21) _____
22) TYPE: _____ INTERLOCKED (POSITIVE) _____ OTHER: _____
23) _____ SERVED ARMOR _____ BONDED BARRIER
24) MATERIAL: _____ GALVANIZED STEEL _____ ALUMINUM
25) _____ OTHER: _____
26) COVERING: _____ POLYVINYL CHLORIDE _____ OTHER: _____
27) COLOR: _____ BLACK _____ OTHER: _____
28) SPECIAL REQUIREMENTS: _____
29) _____
30) _____

MARKING

CONDUCTOR IDENTIFICATION

31) _____
32) _____
33) SINGLE-CONDUCTOR: _____
34) MULTI-CONDUCTOR: _____
35) _____

CABLE MARKING

36) _____
37) REQUIRED: _____ MANUFACTURER _____ CONDUCTOR SIZE
38) _____ NO. OF CONDUCTORS _____ VOLTAGE RATING
39) _____ UL LABEL _____ NEC TYPE
40) _____ TEMPERATURE RATING _____ MONTH/YEAR OF MANUFACTURE
41) _____ OTHER: _____
42) _____

FACTORY TESTING/DOCUMENTATION

43) _____
44) _____ PHYSICAL _____ FLAME TESTS (SPECIFY STANDARDS) _____
45) _____
46) _____ ELECTRICAL _____ OTHER TESTS: _____
47) _____ MEGGER _____
48) _____ OTHER: _____
49) _____
50) _____

THERMOCOUPLE EXTENSION CABLE

**DATA SHEET 4 of 4
QUALITY ASSURANCE**

1) _____
2) _____ NO ADDITIONAL REQUIREMENTS _____ ATTACHED SPECIFICATION _____
3) _____

PACKAGING

4) _____
5) _____ DOMESTIC _____ EXPORT _____
6) _____

SHIPPING

7) _____
8) REEL TYPE: _____ RETURNABLE _____ NON-RETURNABLE _____ LENGTH PER REEL _____
9) _____

10) ADDITIONAL REQUIREMENTS: _____
11) _____
12) _____
13) _____

MANUFACTURER DATA

14) _____
15) _____
16) CABLE DIMENSION (O.D. IN.) _____ SHIPPING TIME _____
17) CABLE CROSS-SECTIONAL AREA _____ OTHER _____
18) CABLE WEIGHT (LBS/FT) _____
19) CABLE MIN BENDING RADIUS _____
20) TENSILE STRENGTH _____
21) GROSS WEIGHT/REEL (LBS) _____
22) TOTAL CUBIC FEET/REEL _____
23) SHORT CIRCUIT WITHSTAND CURVES _____
24) CABLE TESTING REQUIREMENTS _____
25) _____

NOTES

26) _____
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Section 16126

INSTRUMENTATION CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specifications for instrumentation cable.

1.02 REFERENCES CODES AND STANDARDS

- A. The equipment in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):
 - 1. NFPA 70 – National Electrical Code (NEC)
 - 2. NEMA WC-5 – Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
 - 3. ANSI/TIA/EIA 606A – Standard for telecommunications Infrastructure.

1.03 SUBMITTALS

- A. Shop Drawings
 - 1. Submit catalog data of all wire and cable, connectors and accessories, specified under this Section with all selections, options and exceptions clearly indicated.
- B. Certified Tests
 - 1. Submit a test report of all installed wire insulation tests.
- C. Operation and Maintenance Manuals
 - 1. Submit Operation and Maintenance Manuals containing installation and maintenance instructions for splice and termination kits.

1.04 QUALITY ASSURANCE

- A. The general construction of the wire, cables and the insulation material used shall be similar to that used for cable of the same size and rating

INSTRUMENTATION CABLE

in continuous production for at least 15 years and successfully operating in the field in substantial quantities.

- B. Wire and cable with a manufacture date of greater than twelve (12) months previous will not be acceptable.
- C. Wire and cable shall be in new condition, with the manufacturer's packaging intact, stored indoors since manufacture, and shall not have been subjected to the weather. Date of manufacture shall be clearly visible on each reel.
- D. The manufacturer of these materials shall have produced similar electrical materials for a minimum period of five (5) years. When requested by the Owner/Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.05 JOBSITE DELIVERY, STORAGE AND HANDLING

- A. Prior to jobsite delivery, the Contractor shall have successfully completed all submittal requirements, and present to the Owner/Engineer upon delivery of the equipment, an approved copy of all such submittals. Delivery of incomplete constructed equipment, or equipment which failed any factory tests, will not be permitted.
- B. Check for reels not completely restrained, reels with interlocking flanges or broken flanges, damaged reel covering or any other indication of damage. Do not drop reels from any height.
- C. Unload reels using a sling and spreader bar. Roll reels in the direction of the arrows shown on the reel and on surfaces free of obstructions that could damage the wire and cable.
- D. Store cable on a solid, well drained location. Cover cable reels with plastic sheeting or tarpaulin. Do not lay reels flat.

PART 2 P R O D U C T S

2.01 MANUFACTURERS

- A. Alpha Wire Corporation
- B. Belden Division, Cooper Industries, Inc.
- C. Continental Cables Company

D. General Cable Company

E. Okonite Company

2.02 MATERIALS AND EQUIPMENT

A. Cables for 4 20 ma, R.T.D., potentiometer and similar signals shall be PLTC rated and shall be:

1. Single pair cable:

Conductors: 2 #16 stranded, tinned and twisted on 2 in lay
Insulation: PVC with 600 volt, 90 degrees C rating
Shield: 100 percent mylar tape with drain wire
Jacket: PVC with manufacturer's identification
Misc: UL1685 listed for underground wet location use
Manufacturers: Okonite, Belden or approved equal

2. Three conductor (triad) cable:

Conductors: 3 #16 stranded, tinned and twisted on 2 in lay
Insulation: PVC with 600 volt, 90 degrees C rating
Shield: 100 percent mylar tape with drain wire
Jacket: PVC with manufacturer's identification
Misc: UL1685 listed for underground wet location use
Manufacturers: Okonite, Belden or approved equal

3. Multiple pair cables (where shown on the Drawings:

Conductor: Multiple pairs, #16 stranded, tinned and twisted on a 2 in lay
Insulation: PVC with 600 volt, 90 degrees C rating
Shield: Individual pairs shielded with 100 percent mylar tape and drain wire
Jacket: PVC with manufacturer's identification
Misc: UL1685 listed for underground wet location use
Manufacturers: Okonite, Belden or approved equal

2.03 COMMUNICATION CABLES

A. Cables for Ethernet and RS485 shall be rated and shall be:

1. Category 5e above Grade shielded Cable

Conductors: 4 bonded pair 24AWG Bare Copper
Insulation: Polyolefin

INSTRUMENTATION CABLE

Shield: 100 percent aluminum foil polyester tape with drain wire
Jacket: PVC with 600 volt rated and manufacturer's identification

Misc.: UL21047 and UL1666 listed for indoor and dry locations use

Manufacturers: Belden 7957A or approved equal

2. Category 5e above Grade un-shielded Cable

Conductors: 4 bonded pair 24AWG Bare Copper

Insulation: Polyolefin

Jacket: PVC with 300 volt rated and manufacturer's identification

NEC CMR

Misc.: UL1666 listed for indoor and dry locations use

Manufacturers: Belden 7923A or approved equal

3. Category 6 above Grade -shielded Cable

Conductors: 4 bonded pair 23AWG Bare Copper

Insulation: Polypropylene

Shield: 100 percent aluminum foil polyester tape with drain wire

Jacket: PVC with 600 volt rated and manufacturer's identification

Transmission Standards: Category 6 - TIA 568.C.2

NEC CMR

Flame Test Method: UL1666 Vertical Riser listed for indoor and dry locations use

Manufacturers: Belden 7953A or approved equal

4. Category 6 above Grade un-shielded Cable

Conductors: 4 bonded pair 23AWG Bare Copper

Insulation: Polyolefin

Jacket: PVC with 300 volt rated and manufacturer's identification

Transmission Standards: Category 6 - TIA 568.C.2

Nominal Velocity of Propagation: 72 %

Flame Test Method: UL1666 Vertical Riser listed for indoor and dry locations use

Manufacturers: Belden 7940A or approved equal

5. Category 5e below Grade shielded Cable

Conductors: 4 pair 24AWG Bare Copper

Insulation: Polyolefin

Shield: 100 percent aluminum foil polyester tape with drain wire

Jacket: LLPE (Linear Low Density Polyethylene) with 300 volt rated and manufacturer's identification

Misc.: NEMA WC-63.1, listed for outdoor and wet locations use

Manufacturers: Belden 7937A or approved equal

6. 485 Communications Cable

Conductors: 1 pair 24AWG Tinned Copper

Insulation: Polyethylene

Shield: 100 percent aluminum foil polyester tape with tinned copper drain wire

Jacket: PVC with 300 volt rated and manufacturer's identification

Misc.: UL2919 listed for indoor and dry locations use

Manufacturers: Belden 9841 or approved equal

PART 3 EXECUTION

3.01 PREPARATION

- A. Complete cable raceway systems, underground duct banks and cable support systems before installing cables.
- B. Verify sizing of raceways and pullboxes to ensure proper accommodation for the cables.
- C. Check the length of the cable raceway system against the length of cable on the selected reel.
- D. Do not install or work on PVC insulated or jacketed cables in temperatures below 32 degrees F.
- E. Clean and swab conduits of foreign matter before cables are pulled.
- F. Provide at least 30 percent spare conductors or pairs.

3.02 INSTALLATION

- A. Cable in Conduit and Ductbank
 - 1. Install cables in accordance with the manufacturer's instructions and NEC Article 725 - Class 1, Class 2, and Class 3 Remote Control, Signaling and Power Limited Circuits. Do not exceed maximum wire tension, maximum insulation pressure and minimum bending radius.
 - 2. Instrumentation cables shall be installed in raceways as specified. Unless specifically shown on the Drawings, all instrumentation circuits

INSTRUMENTATION CABLE

shall be installed as single shielded twisted pair cables or single shielded twisted triads. In no case shall a circuit be made up using conductors from different pairs or triads. Triads shall be used wherever three wire circuits are required.

3. Terminal blocks shall be provided at all instrument cable junction boxes, and all circuits shall be identified at such junctions.
 4. Shielded instrumentation wire, coaxial cable, data highway cable, discrete I/O, multiple conductor cable, and fiber optic cables shall be run without splices between instruments, terminal boxes, or panels. The shield shall be continuous for the entire run.
 5. Pull cables into conduits using adequate lubrication to reduce friction. Lubricants must not be harmful to the conductor insulation or cable jacket.
 6. Conduits carrying low level signal cables shall be PVC-coated rigid steel.
- B. Cable in Tray. Install instrument and signal cable in cable tray only when the tray is dedicated for this type cable and cables are approved for tray installation.
- C. Termination
1. Do not splice conductors. For termination use crimp-on type ring tongue non-insulated tin plated copper lugs.
 2. For shielded control cable, terminate the shield and ground it at one end only, preferably at the control panel end for instrument and communication cable and at the supply end for electronic power cables.
 3. Splices of Instrumentation conductors will not be permitted between terminal points. Terminations shall be made with connectors as specified. The shield of pair shielded and triad shielded shall be terminated on terminal strips.
 4. Mark wiring on both ends with circuit numbers or loop tag numbers. Heat shrink wire markers after the ring tongue terminal has been installed. Extend the marker over the crimp or base of the terminal.

D. Tests

1. Before connecting the cables, test insulation integrity and conductor continuity.
2. Use a 500 VDC megohmmeter and perform the cable insulation test in accordance with the operating instructions.

- E. Termination: After instrumentation cable installation and conductor termination by the instrumentation and control supplier, perform tests to ensure that instrumentation cable shields are isolated from ground, except at the grounding point in the instrumentation control panel. Remove all improper grounds.

END OF SECTION

INSTRUMENTATION CABLE

DATA SHEET 1 of 4

1. **IDENTIFICATION**

2. CLIENT _____ MANUFACTURER _____

3. PROJECT _____ MODEL NO. _____

4. JOB NO. _____ SIZE _____

5. PLANT/LOCATION _____ SERIAL NO. _____

6. ITEM NO. _____ INQUIRY NO. _____

7. SERVICE _____ P.O. NO. _____

8. QUANTITY REQUIRED _____

9. **NOTE: [] INDICATES INFORMATION TO BE COMPLETED BY MANUFACTURER**

10. **ENVIRONMENTAL CONDITIONS**

11. _____

12. _____

13. TEMPERATURE RANGE: MAX _____ °C, MIN _____ °C

14. INSTALLATION: _____ ENCLOSED _____ OUTDOORS _____ INDOORS _____

15. _____ UNDERGROUND _____ UNDERWATER _____

16. EXPOSURE: _____ MOISTURE _____ DIRT _____ OZONE _____

17. _____ RADIATION _____ CHEMICALS:(PLEASE LIST) _____

18. _____

19. SOILS: (PLEASE LIST) _____ ELECTROSTATIC INTERFERENCE _____

20. ELECTROMAGNETIC INTERFERENCE DISTURBANCES _____ RODENTS _____

21. OTHER: _____

22. _____

23. _____

24. **PHYSICAL REQUIREMENTS**

25. _____

26. FLEXIBILITY: _____ VERY FLEXIBLE _____ FLEXIBLE _____ NOT CRITICAL _____

27. RESISTANCE TO: _____ ABRASION _____ IMPACT _____ CRUSH _____

28. _____ DEFORMATION _____ CUT THROUGH _____ COLD FLOW _____

29. TERMINATION METHOD: _____

30. _____

31. _____

32. STRIPPABILITY: _____ MANUAL _____

33. _____ AUTOMATIC EQUIPMENT TYPE _____

34. _____

35. **ELECTRICAL REQUIREMENTS**

36. _____ FREQUENCY (HZ) _____ CROSS TALK (ISOLATION IN DB AT FREQ) _____

37. _____ CURRENT (MILLIAMPS) _____ DC RESISTANCE (OHMS/1000 FT) _____

38. _____ CAPACITANCE (PFD) _____ VOLTAGE BREAKDOWN (VOLTS/MILL) _____

39. _____ ATTENUATION (DB/100 FT) _____ INSULATION RESISTANCE (MEGOHMS/1000 FT) _____

40. ADDITIONAL REQUIREMENTS: _____

41. _____

42. _____

43. _____

44. _____

45. _____

46. _____

47. _____

48. _____

49. _____

50. _____

ITEM NO. _____

DATA SHEET 2 of 4

1. **CONSTRUCTION**
2. **CONDUCTORS**

3. SIZE (AWG): _____
4. _____ COPPER _____ STEEL _____ TINNED
5. _____ BARE _____ SOLID _____ COPPER COATED
6. _____ STRANDED _____ SILVER COATED
7. NUMBER OF CONDUCTORS: _____ NUMBER OF PAIRS _____
8. _____ NUMBER OF TRIADS _____
9. ADDITIONAL REQUIREMENTS: _____

11. **INSULATION**

12. RUBBER: _____ SBR _____ NATURAL _____ SYNTHETIC _____ BUTYL POLYBUTADIENE
13. _____ NEOPRENE _____ NBR _____ EPR/EPT
14. _____ CHLORSULFONATED POLYETHYLENE _____ SILICONE
15. PLASTIC: _____ PVC _____ LOW-DENSITY POLYETHYLENE _____ CELLULAR POLYETHYLENE _____
TEFLON _____ HIGH-DENSITY POLYETHYLENE POLYPROPYLENE _____ POLYURETHANE
17. _____ NYLON _____ OTHER: _____
18. VOLTAGE RATING: _____ AC _____ DC WALL THICKNESS _____
19. LAY LENGTH PER INCH OF PAIRS: _____ LAY _____ TWIST
20. DRAIN WIRE: _____ SIZE _____ STRANDED _____ SOLID _____ BARE COPPER _____ TIN-COATED COPPER
21. COLOR _____
22. TEMPERATURE RATING: _____ 60° - 75°C (WET-DRY) _____ 75°C - 90°C (WET-DRY)
23. _____ 90°C (WET-DRY) _____ OTHER: _____
24. SPECIAL REQUIREMENTS: _____

27. **SHIELDING**

28. TYPE SHIELDING: _____ BRAIDED _____ CONDUCTIVE PLASTIC
29. _____ CONDUCTIVE COTTON _____ SPIRAL-SERVED
30. _____ MYLAR FILM-ALUMINUM FOIL _____ POLYESTER FILM-ALUMINUM FOIL
31. _____ OTHER: _____
32. _____
33. POLYESTER FILM-ALUMINUM LOCATION: _____ INSIDE _____ OUTSIDE _____ PAIR SHIELD ISOLATED
34. _____ SEPARATOR _____ FILTER

36. **SHIELD COMBINATION**

37. OVERSHIELD: _____ POLYESTER FILM-ALUMINUM _____ BRAID _____ SERVED
38. _____ OTHER: _____
39. BRAID SHIELD: _____ TYPE STRANDS _____ % COVERAGE _____ TINNED
40. _____ BARE _____ COPPER _____ ALUMINUM
41. OVERALL TYPE: _____ POLYESTER _____ PAPER _____ OTHER: _____

44. **JACKET**

45. TYPE: _____ POLYVINYL CHLORIDE _____ POLYETHYLENE
46. _____ HEAVY DUTY NEOPRENE _____ CHLOROSULFONATED POLYETHYLENE
47. _____ NYLON _____ OTHER: _____

ITEM NO. _____

INSTRUMENTATION CABLE

DATA SHEET 3 of 4

1. **JACKET (Cont)**

2. THICKNESS (MILS OR MM) _____

3. COLOR: _____ BLACK _____ OTHER: _____

4. SPECIAL REQUIREMENTS: _____

5. _____

6. _____

7. **ARMORING**

8. TYPE: _____ INTERLOCKED (POSITIVE) OTHER: _____

9. MATERIAL: _____ GALVANIZED STEEL _____ ALUMINUM _____

10. OTHER: _____

11. COVERING: _____ POLYVINYL CHLORIDE _____ OTHER: _____

12. COLOR: _____ BLACK _____ OTHER: _____

13. SPECIAL REQUIREMENTS: _____

14. _____

15. _____

16. **MARKING**

17. **CONDUCTOR IDENTIFICATION**

18. SINGLE-CONDUCTOR: _____

19. MULTI-CONDUCTOR: _____

20. _____

21. **CABLE MARKING**

22. REQUIRED: _____ MANUFACTURER _____ CONDUCTOR SIZE

23. _____ NO. OF CONDUCTORS _____ VOLTAGE RATING

24. _____ UL LABEL _____ NEC TYPE

25. _____ TEMPERATURE RATING _____ MONTH/YEAR OF MANUFACTURE

26. _____ OTHER: _____

27. _____

28. **FACTORY TESTING/DOCUMENTATION**

29. _____ PHYSICAL _____ FLAME TESTS (SPECIFY STANDARDS) _____

30. _____

31. _____ ELECTRICAL _____ OTHER TESTS: _____

32. _____ MEGGER _____

33. _____ OTHER: _____

34. _____

35. _____

36. _____

37. **QUALITY ASSURANCE**

38. _____ NO ADDITIONAL REQUIREMENTS _____ ATTACHED SPECIFICATION _____

39. _____

40. **PACKAGING**

41. _____ DOMESTIC _____ EXPORT

42. _____

43. **SHIPPING**

44. REEL TYPE: _____ RETURNABLE _____ NON-RETURNABLE _____ LENGTH PER REEL _____

45. ADDITIONAL REQUIREMENTS: _____

46. _____

47. _____

48. _____

49. _____

50. _____

ITEM NO. _____

DATA SHEET 4 of 4

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____
- 6. _____
- 7. _____
- 8. _____
- 9. _____
- 10. _____

MANUFACTURER DATA

CABLE DIMENSION (O.D. IN.) _____ SHIPPING TIME _____
CABLE CROSS-SECTIONAL AREA _____ OTHER _____
CABLE WEIGHT (LBS/FT) _____
CABLE MIN BENDING RADIUS _____
TENSILE STRENGTH _____
GROSS WEIGHT/REEL (LBS) _____
TOTAL CUBIC FEET/REEL _____
SHORT CIRCUIT WITHSTAND CURVES _____
CABLE TESTING REQUIREMENTS _____

NOTES

- 11. _____
- 12. _____
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Section 16131

DEVICE, PULL AND JUNCTION BOXES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Specifications for device, pull, and junction boxes.

1.02 REFERENCES

A. All products and components shown on the Drawings and listed in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NFPA 70 – National Electrical Code (NEC)
2. NFPA 70E – Standard For Electrical Safety in the Workplace
3. UL 6A – Electrical Rigid Metal Conduit
4. ANSI C80.5 – Electrical Rigid Aluminum Conduit
5. UL 514B – Outlet Bodies

B. All equipment components and completed assemblies specified in this Section of the Specifications shall bear the appropriate label of Underwriters Laboratories (UL).

1.03 SUBMITTALS

A. Submit the following under provisions of Section 01330 – Submittal Procedures:

1. Manufacturer's cut sheets, catalog data
2. Instruction for handling and storage
3. Installation instructions
4. Dimensions and weights

1.04 QUALITY ASSURANCE

DEVICE, PULL AND JUNCTION BOXES

- A. The manufacturer of these materials shall have produced similar electrical materials and equipment for a minimum period of five (5) years. When requested by the Owner/Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- B. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly. All assemblies shall be of the same manufacturer.
- C. The Contractor's installer of materials specified herein shall have a minimum of five (5) years' experience in the installation of each type of material. Proof of experience shall be submitted, upon request of the Owner/Engineer, prior to installation.

1.05 JOBSITE DELIVERY, STORAGE AND HANDLING

- A. Prior to jobsite delivery, the Contractor shall have successfully completed all submittal requirements, and present to the Owner/Engineer upon delivery of the equipment, an approved copy of all such submittals. Delivery of incomplete constructed equipment, or equipment which failed any factory tests, will not be permitted.
- B. Materials shall be handled and stored in accordance with manufacturer's instructions.
- C. Materials shall not be stored exposed to sunlight. Such materials shall be completely covered.
- D. Materials showing signs of, previous or jobsite, exposure will be rejected.

1.06 WARRANTY

- A. Prior to jobsite delivery, the Contractor shall have successfully completed all submittal requirements, and present to the Owner/Engineer upon delivery of the equipment, an approved copy of all such submittals. Delivery of incomplete constructed equipment, or equipment which failed any factory tests, will not be permitted.

PART 2 P R O D U C T S

2.01 ACCEPTABLE MANUFACTURERS

- A. Sheet Metal Boxes

1. Hoffman Industrial Products
2. Pauluhn Electric Manufacturing Company
3. Hennessy
4. Tanco
5. Tejas
6. Circle A.W.

B. Cast Device Boxes

1. Appleton Electric Company
2. Crouse-Hinds, Division of Cooper Industries
3. Killark Electric Manufacturing Company

2.02 MATERIALS AND EQUIPMENT

A. Sheet Metal Boxes

1. Provide UL-approved junction boxes and pull boxes manufactured from stainless steel sheet metal and meeting requirements of NEMA 4X for corrosive and wet area, NEMA 250 and NEC Article 314.
2. Provide boxes with a stainless steel continuous hinge, closure hasps and all- stainless steel hardware. Junction boxes shall be mounted so the door opens to the right or to the left.
3. Furnish the door with neoprene gasket and provision for padlock.

B. Device Boxes

1. Boxes specified herein, including terminal boxes, junction boxes and pull boxes, are for use with raceway systems only, but include switch, receptacle and lighting housings. Boxes used for housing electrical and instrumentation equipment, other than terminal boxes, shall be as described elsewhere in these Specifications. All raceway boxes shall be provided with a common ground point and UL rated.
2. Classified Areas, NEMA 7/4X (Class 1, Division 1, Groups A, B, C, and D, or as defined in NFPA 70). Boxes shall be constructed as follows:

DEVICE, PULL AND JUNCTION BOXES

- a. Copper free cast aluminum body and cover
- b. Stainless steel hinges
- c. Watertight neoprene gasket
- d. Stainless steel cover bolts
- e. Manufacturers
 - 1) Cooper Crouse Hinds Type EJB, Style C
 - 2) Appleton Electric Type AJBEW
 - 3) Approved Equal

C. Device Boxes

- 1. Provide UL-approved boxes designed and manufactured to house electrical devices like receptacles and switches, and in conformance with NEMA FB1 and NEC Article 314.
- 2. Supply boxes that are hot-dip galvanized or cast iron suitable for corrosive and wet atmosphere.

D. Hardware

- 1. Mounting Hardware: Stainless steel
- 2. Conduit Connectors: Watertight as manufactured by Myers Hubs, or equal.

PART 3 EXECUTION

3.01 PREPARATION

- A. Review the drawings and determine how many boxes of each kind are required and check if supplied quantity is sufficient.

3.02 INSTALLATION

- A. Boxes described in this specification shall be used both in dry and wet, corrosive areas, both inside and outside locations.

- B. Install boxes in accordance with NEC Article 314 in locations indicated on the Drawings. Junction boxes shall be mounted so the door opens to the right or to the left.
- C. Install junction and pull boxes in readily accessible places to facilitate wire pulls, maintenance and repair. Junction boxes shall be sized for the number and size of conduits that enter the junction box.
- D. Plug unused conduit openings.
- E. Make conduit connections to sheet metal boxes with watertight conduit connectors.
- F. Label boxes with phenolic nameplates as required in Section 16195.

END OF SECTION

DEVICE, PULL AND JUNCTION BOXES

*11th Street Facility Odor Control
WBS No.: R-000020-0010-3*

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Section 16140

WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specifications for wiring devices including:

1. Receptacles.
2. Wall switches.
3. Wall plates and cover plates.

1.02 REFERENCES

A. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA):

1. NEMA WD1 - General Purpose Wiring Devices.
2. NEMA WD6 - Dimensional Requirements.

B. Federal Specifications (WC-596F).

C. American National Standards Institute/National Fire Protection Association (NFPA):

1. NFPA No. 70 - National Electrical Code (NEC), Articles 210 Branch Circuits, 250 Grounding and 410, Paragraphs 56, 57 and 58.

1.03 SUBMITTALS

A. Submit the following under provisions of Section 01330 – Submittal Procedures:

1. Product Data: Manufacturer's product literature and specifications including dimensions, weights, certifications and instructions for handling, storage and installation.

1.04 DELIVERY, STORAGE AND HANDLING

A. Pack and crate devices to permit ease of handling and protect from

WIRING DEVICES

damage during shipping, handling and storage.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Bryant Electric
- B. Crouse-Hinds, Arrow Hart Division
- C. Hubbel Inc. Wiring Devices Division
- D. Leviton Manufacturing Company
- E. Pass & Seymour/Legrand.

2.02 MATERIALS AND EQUIPMENT

- A. Standards: Conform to NEMA WD1 for general requirements and NEMA WD6 for dimensional requirements.
- B. Manufacture devices to heavy-duty industrial specification grade with brown nylon bodies (orange for isolated-ground receptacles) back and side wiring provisions and green-colored grounding screws.
- C. Receptacles:
 - 1. Duplex-type receptacles: Rated 20 amps at 120 volts.
 - 2. Contacts: Brass or phosphor bronze.
 - 3. Receptacle grounding system: Extend to the mounting strap unless isolated ground is indicated or required.
 - 4. GFI or GFCI (ground fault circuit interrupter) receptacles: Provide feed-through type with test and reset button.
- D. Wall Switches:
 - 1. Toggle switches: Singel pole, 20 Amp, 120/277 Volt - Cooper, Catalog No. 2221V, similar to Hubbell, Inc.; Pass & Seymour, Inc. or equal.
 - 2. Double pole, 20 Amp, 120/277 Volt - Cooper, Catalog No. 2222V, similar by Hubbell, Inc.; Pass & Seymour, Inc. or equal.

3. Three way, 20 Amp, 120/277 Volt - Cooper, Catalog No. 2223V, similar by Hubbell, Inc.; Pass & Seymour, Inc. or equal.

E. Cover Plates:

1. In outdoor, corrosive and wet areas, provide cover plates of heavy duty plastic, gasketed with hinged covers that remain waterproof while still in use and stainless steel hardware.
2. All other plates: Type 316 stainless steel.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that device boxes are correctly placed.
- B. Verify that the correct quantity, size and type of wires are pulled to each device box.
- C. Verify that wiring has been checked at both ends.
- D. Prepare wire ends for connection to devices.
- E. Inspect each wiring device for defects.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install receptacles with grounding pole on top.
- E. Connect wiring device grounding terminal to outlet box with bonding jumper.
- F. Connect wiring devices by wrapping conductors clockwise around screw terminals.
- G. Install cover plates on switch, receptacle and blank outlets in finished areas.
- H. Energize and test devices for proper operation.

WIRING DEVICES

END OF SECTION

Section 16160

CABINETS AND ENCLOSURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specifications for cabinets and enclosures for housing of control panels and motor controls.

1.02 REFERENCES

- A. National Electrical Manufacturers Association (NEMA).
 - 1. 250 - Enclosures for Electrical Equipment (1000 volts maximum).
 - a. NEMA 3 - Enclosures for outdoor use primarily to provide a degree of protection against wind-blown dust, rain, and sleet; undamaged by formation of ice on the enclosure.
 - b. NEMA 12 - Enclosures for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping non-corrosive liquids.
 - c. Provide NEMA 4X 316 Stainless Steel enclosures for outdoor and wet locations or as specified on drawings.
- B. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), NFPA 70 - National Electrical Code (NEC), Article 312 - Cabinets, Cutout Box, and Meter Socket Enclosures.
- C. Underwriters Laboratories (UL), UL 50 - Safety for Cabinets and Boxes.

1.03 SUBMITTALS

- A. Submit the following under provisions of Section 01330 – Submittal Procedures:
 - 1. Manufacturer's cut sheets and catalog data
 - 2. Instruction for handling and storage
 - 3. Installation instructions

CABINETS AND ENCLOSURES

4. Dimensions and weights

1.04 DELIVERY, STORAGE AND HANDLING

- A. Have cabinets and enclosures packed and crated to permit ease of handling and to provide protection from damage during shipping, handling and storage.

PART 2 P R O D U C T S

2.01 ACCEPTABLE MANUFACTURERS

- A. The EMF Company
- B. Hennessey Products, Inc.
- C. Hoffman Industrial Products
- D. Pauluhn Electric Manufacturing Company
- E. Weigman Company
- F. Rose Enclosure
- G. N.E.M.A. Enclosure Mfg. Co.
- H. Rittal

2.02 MATERIALS AND EQUIPMENT

- A. Sheet Metal Boxes
 1. Provide enclosures manufactured in accordance with NEMA 250 and NEC Article 312. Fabricate outdoor NEMA 3 panels from 0.125- inch thick type 5052 H32 aluminum or 14 gauge, 316 stainless steel for installation in areas that are not air conditioned. NEMA 12 indoor panels for installation in air conditioned areas shall be painted steel.
 2. Dimensions and special features are shown on the Drawings.
 3. Construct outdoor enclosures with continuously welded seams ground smooth.

4. Additional material thickness and bracing requirements shall be determined by the manufacturer to provide the strength required by the standard listed. The bracing shall be provided in such a way as to minimize the protrusion into the wiring and the equipment spaces.
5. Install the door with a stainless steel continuous hinge, stainless steel padlock handle with gasket and stainless steel hardware. Junction boxes shall be mounted so the door opens to the right or to the left.
6. Furnish the door with oil-resistant neoprene gasket attached with oil-resistant adhesive and held in place with aluminum retaining strips.
7. Use a single, 3/4-inch minimum, door handle that provides a 3-point latching through latch rods with rollers. Provide rollers with at least 3/4-inch diameter.
8. Gasketed overlapping doors may be used instead of a center post.
9. Provide heavy duty lifting eyes of suitable material.
10. Fabricate the enclosure with a stud-mounted panel inside. Make panels from 12-gauge steel painted with white enamel finish.
11. Equip both NEMA 12 and NEMA 3 enclosures with thermostatically controlled space heaters and corrosion inhibitors. Provide heaters rated for 240V for 120V operation.
12. Weld mounting feet to the enclosure if called for on the Drawing.
13. Include a high impact plastic data pocket in the enclosure.
14. Provide ground connections on the enclosures to enable grounding of the enclosure with a No. 2 AWG conductor.
15. Equip free-standing outdoor cabinets with inner and outer door restraint bars to prevent door swing during windy conditions.
16. Supply indoor enclosures with filtered passive air intake and exhaust openings, 4-inch square in the side near the top and near the bottom of the adjacent side panel.

B. Hardware

1. Mounting Hardware: Stainless steel

CABINETS AND ENCLOSURES

2. Conduit Connectors: Watertight as manufactured by Myers Hubs, or equal.

2.03 TESTING

- A. Test cabinets and enclosures in accordance with UL 50 so unit qualifies for a UL label.

PART 3 EXECUTION

3.01 PREPARATION

- A. Review Drawings and determine how many enclosures of each kind are required and check if supplied quantity is sufficient.
- B. Check the mounting pads or foundations for proper mounting dimensions and features, including grounding conductor stub-up.

3.02 INSTALLATION

- A. Use enclosures described in this specification only above grade.
- B. Install enclosures in accordance with NEC Article 312 in locations as indicated on the Drawings.
- C. Install enclosures in readily accessible locations to facilitate general operations, wire pulls, maintenance and repair.
- D. Plug unused conduit openings.
- E. Make conduit connections to the enclosures with watertight conduit connectors.
- F. Identify all components in cabinets with phenolic nameplates as required in Section 16195.
- G. Use pre-printed tubular heat-shrink type wire and cable markers to label each end of all conductors.

END OF SECTION

Section 16161

PANELBOARDS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Specifications for panelboards.

1.02 REFERENCES

- A. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA)
 - 1. NEMA AB1: Molded Case Circuit Breakers
 - 2. NEMA PB1: Panelboards
 - 3. NEMA PB1.1: Instruction for Safe Installation Operation and Maintenance of Panelboards rated 600 volts or less.
 - 4. NEMA PB1.2: Application Guide for Ground-fault Protective Devices for Equipment
 - 5. UL 67: Panelboards
 - 6. UL 50: Cabinets and Boxes
 - 7. Fed. Spec W-P-115C
- B. Federal Specifications, FS W-C-375A: Circuit Breakers, Molded Case, Branch Circuit and Service.
- C. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), NFPA No. 70 - National Electrical Code (NEC), Article 408 - Switchboards and Panelboards.
- D. Underwriters Laboratory
 - 1. UL 67: Panelboards
 - 2. UL 50: Cabinets and Boxes

1.03 SUBMITTALS

PANELBOARDS

A. Submit the following under provisions of Section 01330 – Submittal Procedures:

1. Manufacturer's cut sheets and catalog data
2. Breaker arrangement
3. Breaker characteristic curves
4. Instruction for handling and storage
5. Installation instructions
6. Dimensions and weights

1.04 DELIVERY, STORAGE AND HANDLING

A. Have panelboards packed and crated to permit ease of handling and to provide protection from damage during shipping, handling and storage.

PART 2 P R O D U C T S

2.01 ACCEPTABLE MANUFACTURERS

A. Sheet Metal Boxes

1. Eaton Cutler Hammer
2. General Electric
3. Siemens
4. Schneider Electric

2.02 MATERIALS AND EQUIPMENT

A. Basic Requirements

1. Use panelboards manufactured and tested in accordance with NEMA PB 1.
2. Provide circuit breakers of industrial grade, manufactured and tested in accordance with NEMA AB 1 and Federal Specification FS W-C-375.
3. Perform a load analysis to assure the panel rating is not overloaded when new loads are added to existing panels.

- B. Rating
 - 1. Voltage rating, current rating, number of phases, number of wires and number of poles are indicated on Drawings.
 - 2. Branch circuit breaker interrupting capacity shall be minimum 10,000 ampere RMS symmetrical for 208V; 25,000 ampere RMS symmetrical for 480V.
- C. Circuit Breakers: Molded case, bolt-on thermal magnetic type with number of poles and trip ratings as shown on the Drawings. Provide ground fault interrupters with trip rating where shown on the Drawings.
- D. Bus System
 - 1. Bus Bars: 98 percent conductivity copper. Provide a solid neutral bar in 4-wire panelboards. Include ground bus in all panels. Provide split-bus panels where shown on Drawings.
 - 2. Main: Circuit breaker or main lugs only as indicated on the Drawings or as required to meet the current interrupting ratings.
- E. Box and Trim
 - 1. Construction: Code grade steel, ample gutter space, flush door, flush snap latch and lock.
 - 2. Trim: Surface or flush as required. Enclose panelboards located outdoors, in other wet and corrosive areas, or in non-air conditioned areas in NEMA 4X weatherproof stainless steel enclosures. Enclose indoor panelboards installed in air conditioned areas in a NEMA 1 enclosure with manufacturer's standard gray enamel finish.
 - 3. Directory: Typed card, with glass cover in frame on back of door giving the circuit numbers and the area or equipment served.
- F. Conduit Connectors: Watertight as manufactured by Myers Hubs, or equal.

PART 3 EXECUTION

3.01 PREPARATION

- A. Review Drawings to verify that panelboards are correct for the application.

PANELBOARDS

3.02 INSTALLATION

- A. Install the panelboard in accordance with NEMA PB 1.1 and NEC Article 408.
- B. Mount panelboards 6'-0" (to top of cabinet) above finished floor or grade. In wet and corrosive areas, including outdoor locations, install panel enclosures on spacers to provide approximately 1/4-inch between back of cabinet and mounting surface. Mounting hardware shall be type 316 stainless steel.
- C. In wet and corrosive areas, including outdoor locations, connect conduit to the bottom of enclosure and to the lower 30 percent of the sides using watertight connectors.

END OF SECTION

Section 16165

DISCONNECT SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specifications for disconnect switches including:
 - 1. Fusible disconnect switches
 - 2. Non-fusible disconnect switches
 - 3. Circuit breaker type disconnect switches
 - 4. Fuses
 - 5. Circuit breakers

1.02 REFERENCES

- A. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA)
 - 1. NEMA AB1: Molded Case Circuit Breakers
 - 2. NEMA KS1: Enclosed Switches
- B. Underwriters Laboratories (UL)
 - 1. UL 98: Standard for safety enclosed switches and Dead Front Switches
 - 2. UL 198C: High Interrupting Capacity Fuses, Current Limiting type
 - 3. UL 198E: Class R Fuses
- C. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), NFPA No. 70 - National Electrical Code (NEC), Chapter 4.

1.03 SUBMITTALS

- A. Submit the following under provisions of Section 01330 – Submittal Procedures:
 - 1. Manufacturer's cut sheets and catalog data

DISCONNECT SWITCHES

2. Switch internal arrangement
3. Breaker or fuse characteristic curves
4. Instructions for handling and storage
5. Installation instructions
6. Dimensions and weights

1.04 DELIVERY, STORAGE AND HANDLING

- A. Have disconnect switches packed and crated to permit ease of handling and to provide protection from damage during shipping, handling and storage.

PART 2 P R O D U C T S

2.01 ACCEPTABLE MANUFACTURERS

- A. Disconnect Switches and Circuit Breakers:

1. Eaton/ Cutler Hammer
2. General Electric
3. Siemens Energy and Automation
4. Schneider Electric

- B. Fuses

1. Bussman Division, Eaton/ Cooper Industries
2. Gould Shawmut
3. Littlefuse Incorporated

2.02 MATERIALS AND EQUIPMENT

- A. Disconnect Switches

1. Characteristics: Horsepower rated, 600-volt, heavy-duty type with an interlocked door, positive quick-make, quick-break mechanism and visible blades.

2. Use switches and components designed, manufactured and tested in accordance with NEMA AB1, NEMA KS1, UL 98, and NEC Chapter 4.
 3. Enclose switch in a NEMA 12 type enclosure for indoor, air-conditioned applications and NEMA 4X (type 316 stainless steel) in outdoor locations, non-air-conditioned areas, or other wet or corrosive areas.
 4. Provide switches with provisions for padlocking the operating lever in OFF position and door in closed position.
 5. Select switches having the number of poles and general size conforming to the Drawings.
 6. Conform to fusible, non-fusible or circuit breaker type switch requirements as shown on Drawings and required by the NEC, or one-line diagrams.
 7. Provide an auxiliary contact, shown on the Drawings.
 8. Select fuses or circuit breakers with current interrupting duty as calculated for the points of switch application or as indicated on the Drawings or one-line diagrams.
- B. Fuses. Unless otherwise noted on Drawings, for fuses used in disconnect switches, provide the dual-element, time-delay type with the maximum interrupting rating of 200,000 amperes, conforming to the NEC.
- C. Circuit Breakers. When circuit breakers are used in disconnect switches, provide the thermal-magnetic type with current interruption ratings as required at the point of application.
- D. Conduit Connectors: Watertight as manufactured by Myers Hubs, or equal.

PART 3 EXECUTION

3.01 PREPARATION

- A. Review the Drawings and verify that the disconnect switches are correct for the applications.
- B. Make sure that the correct fuses or breakers are being used regarding size and short circuit interrupting capability.
- C. Prepare adhesive labels on the inside door of each switch indicating UL fuse class and size or breaker type and size for replacement.

DISCONNECT SWITCHES

3.02 INSTALLATION

- A. Install the disconnect switches in accordance with and NEC Chapter 4. Disconnect switches shall be mounted in sight of or within 25' of motors and rotating equipment.
- B. Mount switches 6'-6" (to top of cabinet) above finished floor or grade.
- C. In wet and corrosive areas, including outdoor locations, install switches on spacers to provide a space of approximate 1/4-inch between the back of cabinet and the mounting surface.
- D. In wet and corrosive areas, including outdoor locations, connect conduit to the bottom of enclosure and to the lower 30 percent of the sides using watertight connectors.
- E. Disconnect shall be labeled as required in Section 16195.

END OF SECTION

Section 16170

GROUNDING AND BONDING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding electrodes and conductors
- B. Equipment grounding conductors
- C. Bonding
- D. Power system grounding
- E. Communication system grounding
- F. Electrical equipment and raceway grounding and bonding
- G. Control equipment grounding

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM B3: Soft or Annealed Copper Wires
 - 2. ASTM B8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft
 - 3. ASTM B33: Tinned Soft or Annealed Copper Wire for Electrical Purposes
- B. Institute of Electrical and Electronics Engineers (IEEE)
 - 1. IEEE 142-82: Recommended Practice for Grounding of Industrial and Commercial Power Systems
 - 2. IEEE 383-2.5: IEEE Standard for Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations.
- C. Underwriters' Laboratories (UL)

GROUNDING AND BONDING

1. UL 83: Thermoplastic Insulated Wire and Cables
2. UL 467: Grounding and Bonding Equipment

D. National Fire Protection Association (NFPA), NFPA No. 70 - National Electrical Code (NEC), Article No. 250 - Grounding.

1.03 SUBMITTALS

A. Submit the following under the provisions of Section 01330 – Submittal Procedures:

1. Manufacturer's cut sheets and catalog data
2. Installation, terminating and splicing procedure
3. Instruction for handling and storage
4. Dimensions and weight

1.04 QUALITY ASSURANCE

A. Tests

1. Use insulated cable conforming to requirements of the vertical tray flame test as described in IEEE 383-2.5.
2. Test grounding system in the field in accordance with procedures outlined in Part 3 - Execution.

1.05 DELIVERY, STORAGE AND HANDLING

A. Ship grounding cable on manufacturer's standard reel sizes unless otherwise specified. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel. Pack and crate other materials specified to withstand normal abuse during shipping, handling and storage.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Cable

1. Southwire company
2. Superior Essex
3. General Cable Company
4. Okonite Company
5. Pirelli Cable Corporation
6. Rome Cable Corporation
7. Triangle Wire and Cable, Inc.

B. Ground Rods and Connectors:

1. Blackburn
2. Copperweld
3. Thomas & Betts

C. Exothermic Connections:

1. Burndy Corporation (Therm-O-Weld)
2. Erico Products (Cadweld)

D. Grounding Connectors:

1. Burndy Corporation
2. O.Z. Gedney
3. Thomas & Betts

2.02 MATERIALS AND EQUIPMENT

A. Design. Provide grounding cable and materials with the following characteristics:

1. Use a grounding system designed in accordance with NEC Article No. 250 - Grounding, and the IEEE 142-82 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

B. Materials

GROUNDING AND BONDING

1. Use grounding conductors, tin plated bare or insulated, which are manufactured and tested in accordance with applicable standards ASTM B3, ASTM B8 and ASTM B33.
2. Provide a main ground loop of No. 4/0 AWG, Class C stranded, bare copper cable. Small groups of isolated equipment may be grounded by a No. 2 AWG minimum insulated conductor connected to the main loop. Generally, taps shall be sized as follows:
 - a. Main ground loop or grid #4/0 minimum
 - b. Switchgear, motor control centers and power transformers #4/0
 - c. Motors 200 hp and above #4/0
 - d. Power panels - AC and DC #2/0
 - e. Control panels and consoles #2
 - f. Building columns #4/0
 - g. Fencing posts #2/0
3. Where single conductor insulated grounding conductors are called for, use 600-volt insulation. Use ground conductors identified with green insulation or green tape marking.
4. Supply identifying ribbon which is PVC tape, 3 inches wide, red color, permanently imprinted with "CAUTION BURIED ELECTRIC LINE BELOW" in black letters as specified in Section 16195, Electrical Identification.
5. Utilize tin plated flexible copper braid across hinged chain link or fence gates to bond the movable portion to the grounded fence post.

PART 3 EXECUTION

3.01 PREPARATION

- A. Complete site preparation and soil compaction before trenching and driving ground rods for the underground grid.

- B. Verify from Drawings the exact location of stub-up points for grounding of equipment, fences and building or steel structures.

3.02 CONSTRUCTION CRITERIA

- A. The main ground loop at a depth of at least 30 inches below earth surface. Connect the ground loop to ground rods and to tap connections to form a complete system as indicated on the electrical Drawings. The Contractor shall give special attention to the grounding of service equipment, structures and fences to comply with the NEC, local authorities and the serving utility company.
- B. Electrical equipment, buildings, tanks, and other structures and equipment shall be grounded as indicated on the Drawings. Where ground rods are required, the rods shall be 10 feet long, 3/4 inch diameter, copper-clad steel ground rods. Rods shall be driven vertically, and the top of the rods shall be a minimum of 18 inches below finished grade, or as specified on the Drawings. Ground wells will be provided for all driven rods.
- C. Local pushbutton and selector switch stations, two-wire control devices, disconnect switches, lighting transformers, panelboards, operator panels, benchboards, and the enclosures of other electrical apparatus shall be grounded through and equipment grounding conductor run with the power supply or control circuit conductors or shall be grounded as shown on the Drawings.
- D. Ground medium voltage motors, in addition to the grounding conductors in the motor feeder cable, with a separate No. 4/0 AWG cable to motor frame.
- E. Motors having power supplied by multiconductor cable shall be grounded by a separate grounding conductor in the cable and where supplied by single conductor cable in conduit by a grounding conductor pulled in the conduit. Connect ground conductors to the ground bus in the motor control center and to the ground terminal provided in the motor conduit box.
- F. Do not ground the insulated bearing pedestals of large motors.
- G. Connect ladder-type cable trays to the grounding electrode system.
- H. Install a warning ribbon approximately 12 inches below finished grade directly above the ground grid.
- I. Connect fence posts of chain link and metal fences to the main ground loop at least every 50 feet. Install bonding straps to gates.

GROUNDING AND BONDING

3.03 INSTALLATION

A. Equipment Grounding

1. Make grounding connections to surfaces which are dry and cleaned of paint, rust, oxides, scales, grease and dirt to ensure good conductivity. Clean copper and galvanized steel to remove oxide before making welds or connections.
2. Use the exothermic welding process for below-grade grounding connections, except at ground rods. Use mechanical connectors or thermal connections for above-grade grounding connections as shown on the Drawings.
3. Make grounding connections to electrical equipment, vessels, mechanical equipment and ground rods in accordance with the Drawings.
4. Ground tanks and vessels by making connections to integral structural supports or to existing grounding lugs or pads, and not to the body of the tank or vessel.
5. Leave ground connections to equipment visible for inspection. Protect them with PVC non-metallic conduit as indicated on the Drawings.
6. Make connections to motor frames and ground buses with lugs attached to the equipment by means of bolts. Do not use motor anchor bolts or equipment housing for fastening lugs of grounding cable.
7. Where the wiring for lighting systems consists of single conductor cables in conduit, provide each conduit with an equipment grounding conductor. Use a grounding conductor with green colored insulation and ground equipment in the lighting system.

B. Raceway and Support Systems Grounding

1. Install raceway, cable rack or tray and conduit so that it is bonded together and permanently grounded to the equipment ground bus, according to the Drawings. Connection to conduit may be grounding bushing or ground clamp.
2. Install raceway at low voltage motor control centers or other low voltage control equipment so that it is bonded and grounded,

except that any conduit which is effectively grounded to the sheet metal enclosure by bonding bushing or hubs need not be otherwise bonded.

3. Where a grounding conductor is run in or on a cable tray, bonds the grounding conductor to each section of cable tray with a cable tray ground clamp.
 4. Where only grounding conductor is installed in a metal conduit, bond both ends of the conduit to the grounding conductor.
 5. Provide flexible "jumpers" around raceway expansion joints. Use copper bonding straps for steel conduit. Install jumpers across cable tray joints which have been parted to allow for expansion and any hinged cable tray connections.
- C. Fences and Gates. Ground fences, fence posts and gates to the underground grid as shown on the Drawings.
- D. Power System Grounding
1. Solidly ground the secondary neutral of the main power supply transformer either to the ground grid or through an impedance. See Drawings for details.
 2. Solidly ground the neutral of lighting, instrument and control transformers.
- E. Cable Armor and Shields
1. For shielded control cable, terminate and ground the shield at one end only, preferably at the control panel end for instrument and communication cable and at the supply end for electronic power cables. Maintain shield continuity by jumpering the ground shield across connection point where it is broken at junction boxes, or other splice points. Insulate these points from ground.
 2. Connect the ground wire in power cable assemblies at each terminal point to a ground bus, if available, or to the equipment enclosure. Do not carry these ground wires through a "doughnut" current transformer (CT) used for ground fault relaying; do carry ground leads from stress cones through CTs. Ground power cable armor and shield at each terminal point.
- F. Test Wells

GROUNDING AND BONDING

1. Provide access (test wells) for testing the ground grid system at one or several ground rod locations. Make test wells of a pipe surrounding the rod and connections with a cover placed on top at grade level. See Drawings for details.
2. Install a test well at the service entrance pole to serve as the service entrance grounding electrode.

G. Test

1. Perform ground resistance tests after underground installation and connections to building steel are complete, unless otherwise noted on applicable Drawings.
2. Make tests at each ground test well using a "fall of potential" test method. Each ground test well shall not exceed a maximum resistance of 5 ohms. Where measured values exceed this figure, install additional ground rods as required to reduce the resistance to the specified limit.

- H. Inspection. Inspection of the grounding system by the Project Manager and the local Code Inspector must take place before the grid trenches are backfilled.

END OF SECTION

SECTION 16171

LOW VOLTAGE ELECTRIC MOTOR

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specification for low voltage motors. See Specification 11311, Submersible Wastewater Pumps, for motors integral with submersible wastewater pumps.

1.02 RELATED WORK

- A. Specification Section 16195, Electrical Identification.

1.03 REFERENCES

- A. American National Standards Institute/Anti-Friction Bearing Manufacturers Association (ANSI/AFBMA): Load Ratings and Fatigue Life for Ball Bearings.
- B. American National Standards Institute/national Electrical Manufacturers Association (ANSI/NEMA): MG 1 - Motors and Generators.
- C. American National Standards Institute/National Fire Protection Association (ANSI/NFPA): NFPA 70 - National Electrical Code (NEC).
- D. American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - 1. IEEE112 - Standard Test Procedure for Polyphase Induction Motors and Generators
 - 2. IEEE114 - Standard Test Procedure for Single-Phase Induction Motors
- E. American National Standards Institute/Underwriters Laboratories, Inc. (ANSI/UL)
 - 1. UL547 - Thermal Protectors for Motors
 - 2. UL674 - Electric Motors and Generators for Use in Hazardous Locations, Class I Groups C and D, Class II Groups E, F and G

LOW VOLTAGE ELECTRIC MOTORS

- F. Institute of Electrical and Electronics Engineers (IEEE)
 - 1. 85 – 1973 Test Procedure for Airborne Sound Measurements on Rotating Electric Machinery
 - 2. 43 – 2000 Recommended Practice for Testing Insulation Resistance of Rotating Machinery

- G. American Society of Heating, Refrigerating, and Air-conditioning Engineers, Inc. / Illumination Engineering Society of North America (ASHRAE / IES): 90.1-1989, Table 5.1 - Minimum Acceptable Nominal Full-load Motor Efficiencies for Single Speed Polyphase Motors.

1.04 SUBMITTALS

- A. Submit the following under the provisions of Section 01330 – Submittal Procedures:
 - 1. Outline drawings
 - 2. Complete motor data
 - 3. Assembly drawings
 - 4. Anchor bolt location drawings
 - 5. Electrical schematics and wiring diagrams
 - 6. Equipment performance curves and data
 - 7. Bill of installation/assembly materials
 - 8. Equipment weights
 - 9. Catalog data
 - 10. Assembly/disassembly sizes and weights
 - 11. Operating instructions
 - 12. Maintenance and lubrication recommendations
 - 13. Recommended spare parts for startup including prices
 - 14. Special maintenance tool requirements

15. Recommended spare parts list for one year operation
16. Quality control procedures
17. Nondestructive test procedures
18. Acceptance test procedure
19. Surface preparation and painting procedure
20. Shipping, handling, and storage procedures
21. Installation/erection procedure
22. Code compliance certificate
23. Electrical equipment heat run test records
24. Nameplate data
25. Performance/acceptance test report
26. Code data reports

1.05 QUALITY ASSURANCE

A. Tests

1. Inspect and test motors in accordance with specified NEMA standards. Test polyphase motors to the requirements of ANSI/IEEE 112. Test single phase motors to the requirements of ANSI/IEEE 114- 2001. See data sheets for other standard test requirements that may be specified.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Prepare each unit for the type and mode of shipment specified. The preparation shall be suitable for at least six months of outdoor storage from time of shipment requiring no disassembly prior to operation (except for bearing and seal inspections).
- B. Provide instructions as necessary to preserve the integrity of the storage preparation after the equipment arrives at the jobsite.
- C. Coat exterior machined surfaces with a suitable rust preventative.

LOW VOLTAGE ELECTRIC MOTORS

- D. After drained and cleaned, coat internal areas of bearings and auxiliary equipment in oil lubrication systems fabricated from carbon steel with a suitable oil-soluble rust preventative.
- E. Provide threaded openings with steel caps or solid-shank steel plugs. Do not use nonmetallic plugs or caps.
- F. When sleeve bearings are furnished, block the rotor to prevent axial and radial movement.
- G. When space heaters are furnished, make heater leads accessible without disturbing the shipping package. Tag the leads for identification.

PART 2 P R O D U C T S

2.01 MANUFACTURERS

- A. General Electric.
- B. Reliance Electric.
- C. Siemens.
- D. Toshiba.
- E. U.S. Motors.

2.02 DESIGN

- A. This specification defines the minimum requirements for low-voltage, random-wound, squirrel-cage, induction motors in the NEMA frame sizes for classified electrical hazardous and non-classified area service.
- B. Use this specification for the selection and purchase of induction motors purchased separately or furnished with driven equipment as a package.
- C. This specification, along with the reference documents make up the requirements for motors up to and including 200 hp. Use driven equipment specifications to supplement this specification and identify special project requirements.
- D. Motors purchased with this specification will drive pumps, compressors, fans, agitators, conveyors and other similar equipment. Motors will be installed in a plant environment that may include high humidity, storms, salt-laden air, insects, plant life, fungus, rodents as well as traces of petroleum and/or chemicals.

- E. Motors shall perform satisfactorily for the application.
- F. Motors, electrical components and installation shall be suitable for the hazardous area classification (class, group, and division) and shall meet the requirements of ANSI/UL 674 and the NEC.
- G. Make motors suitable for operation in an outdoor corrosive and wet environment.
- H. When motors are furnished with the driven equipment as a package, motors shall also meet the requirements of the driven equipment specification.
- I. Design motors for operation at a temperature of up to 40°/104°F ambient and at an elevation of up to 1000 m/3300 ft above sea level.

2.03 PERFORMANCE REQUIREMENTS

- A. Confirm motors have ample capacity to supply the maximum output demanded by the driven equipment and have a speed-torque-current characteristic appropriate to the driven equipment.
- B. Confirm motors ability to overcome starting load inertia and accelerate the load to rated speed within 15 seconds at 80 percent of rated nameplate voltage, without exceeding the motor time-temperature damage curve.
- C. Design and construct motors for continuous full load duty, and for continuous or intermittent operation under any extreme environmental condition.
- D. Three-phase induction motors shall be ANSI/NEMA MG 1 Design B. Motors driving high-torque loads may be NEMA Design C or D, providing so stated in the proposal.
- E. Single-phase fractional horsepower motors shall be NEMA Design N.
- F. The single speed, polyphase motors shall have efficiencies as shown in ASHRAE/IES Standard 90.1 - 1989, Table 5-1 and ANSI/NEMA MG-1-1998 Table 12-10. Provide motors commonly referred to as "Premium Efficiency" in the Industry.

2.04 ENCLOSURES AND FRAMES

LOW VOLTAGE ELECTRIC MOTORS

- A. Provide motors with NEMA totally enclosed, fan-cooled (TEFC) enclosures.
- B. Motors frames, enclosures, terminal boxes, fan cover guards and air passages shall be cast iron or heavy fabricated steel of such design or proportions as to hold all motor components rigidly in proper position, and shall meet all NEMA requirements. End bells shall be cast iron. Steel sheet or plate used shall have a thickness of at least 1/8 in. Fans, breathers, drains, screens, covers and hardware shall be corrosion-resistant materials. Fractional horsepower motors may have rolled steel stator frame and cast iron brackets with integral mounting feet.
- C. Make motor enclosure fans low inertia, nonsparking type, and suitable for bidirectional rotation and mount on hub with stainless steel bolts.
- D. Furnish each enclosure with a stainless steel automatic breather/drain located at the low point of the enclosure.
- E. Motor frame and enclosure shall have provisions for grounding to the main grounding system. Drill and tap rear foot on horizontal motors and the flange base on vertical motors on the junction box side for a service post ground connector.
- F. Provide motors weighing more than 300 lbs. with lifting eyebolts, rings or lugs capable of supporting the weight of the motor.

2.05 ELECTRICAL REQUIREMENTS

- A. Design motor for 60 Hz power at the nominal operating voltages listed below.
 - 1. 115/230V, single-phase (3/4 hp and smaller).
 - 2. 460V, three-phase (one horsepower and larger).
- B. Induction motors shall be random-wound, squirrel-cage rated for continuous duty and suitable for across-the-line starting, at rated voltage.
- C. Determine motor horsepower, speed, torque and special operating requirements from the requirements of the driven equipment.
- D. Use copper for motor windings and terminal leads. Aluminum is not an allowable material for any portion of the motor other than die-cast rotor (fabricated aluminum rotors are not acceptable). Copper rotors shall not be fabricated using brazing malar and any copper alloy must contain less than two percent phosphorous.

- E. Provide three-phase single speed motors with three leads.
- F. For two-speed motors provide two windings.
- G. Motors shall have a 1.15 service factor (SF) rating.
- H. Motor insulation shall be a minimum of Class F epoxy nonhygroscopic material with temperature rise limited to Class B design rise of 90°C by resistance method at 1.15 SF.
- I. Motors shall operate successfully under running conditions at rated load with variation in voltage and frequency up to the limits set by ANSI/NEMA MG 1-12.44.
- J. Motors shall be suitable for the number of full-voltage starts as required by ANSI/NEMA MG 1-12.50 as a minimum.

2.06 TERMINAL BOXES

- A. Make motor terminal boxes weatherproof and with threaded conduit entrances with water-resistant seals between boxes and motor frame. Design the line-terminal box to allow box to be rotated in four 90 degree steps for bottom, side or top entry of conduit or cable. The main terminal box location shall be determined by the Contractor. Locate terminal box for space heaters (when supplied) on the same side as the line terminal box.
- B. Size the line terminal box so that feeder cables can be connected to motor leads for terminals without damage to the cable or the leads. Oversize the terminal box to exceed the minimum volumes shown in the NEC Section 430-12 and provide adequate space to mount and enclose all devices mounted within.
- C. Furnish the line terminal box with suitable compression ring-type, permanently numbered, cable connectors for incoming bolted-cable connections and one clamp-type ground terminal lug of sufficient size to contain a conductor the same size as motor leads.
- D. Wire accessory leads to a terminal board in a terminal box or boxes separate from the line leads. Supply separate terminal boxes for the leads for space heaters, and temperature detectors, current transformers, and other similar accessories, when supplied.

2.07 ELECTRICAL ACCESSORIES

LOW VOLTAGE ELECTRIC MOTORS

- A. Arrange space heaters to provide optimum uniform heating of the stator winding and prevent condensation in the motor at ambient temperature when motor is not in operation. Space heaters shall be rated 240 V but shall be connected for operation at 115V. Space heaters shall have maximum sheath temperature of 150°C and shall be approved for the specified hazardous area classification.
- B. Provide winding thermal protection, when required, in accordance with ANSI/UL 547 and consisting of differential heat sensing devices embedded in each motor winding. The devices shall be sensitive to both over temperature and rate of temperature rise.

2.08 BEARINGS AND LUBRICATION

- A. Grease or oil-lubricated anti-friction ball or roller bearings are preferred within the application limits. Sleeve-type bearings may be acceptable when recommended by the manufacturer for a particular application. Sealed grease-lubricated bearings are acceptable only for fractional horsepower motors in noncritical service.
- B. Motors shall have proper bearing insulation to prevent circulation of shaft currents and resulting damage. Provide also insulating means for any oil-supply connections and monitoring equipment to prevent electrical bypassing of the bearing insulation.
- C. Bearings for all direct--connected and belted service motors shall have an L₁₀ rating life in accordance with ANSI/AFBMA 9, of at least 40,000 hours.
- D. Size bearing housing for grease-lubricated bearings adequately to minimize need for frequent lubrication. Design bearing housing to prevent loss of grease from the bearing cavity and to prevent entry of foreign material into the bearings. Provide housing for grease-lubricated bearings with two plugged openings accessible from the exterior of the motor, one for receiving a pressure grease fitting, and the other to serve as a drain and vent during greasing.
- E. Provide oil-lubricated bearing housings a reservoir of sufficient depth, to serve as a settling chamber for foreign materials, with a drain plug, and vents as required, accessible from the exterior of the motor. Furnish oil-lubricated motors with a constant oil-level sight gauge mounted on the motor housing and marked with running- and stopped-oil levels.
- F. Provide motors with suitable seals to prevent moisture from entering through the shaft openings. For applications where hoses and water are used for cleanup, provide an Inpro/Seal isolator (labyrinth seal) on the shaft end of the motor.

- G. For in-line pumps, special high thrust bearings are required for drive motors, except for pumps where the thrust bearings are provided as an integral part of the pump.

2.09 ADDITIONAL REQUIREMENTS FOR VERTICAL MOTORS (NOT REQUIRED)

- A. Solid shaft vertical motors are acceptable for all applications except when the connection to the driven equipment consists of sectional driven shaft which may unscrew and lengthen in the event of reversal of direction.

- B. Hollow-shaft vertical motors are acceptable for all applications when the thrust is in the direction to engage the coupling.

- C. Hollow-shaft vertical motors coupled to a sectional drive shaft with screwed joints shall have special couplings described as follows:

1. Provide motors, except the explosion proof type, with self-releasing couplings designed to disconnect motor from driven equipment and permit lengthening of drive shaft upon reversal of rotation.
2. Provide explosion proof motors with non-reversing couplings of spark-resisting construction, designed to prevent reverse rotation.

- D. Design vertical motor thrust bearings conservatively to carry maximum axial thrusts (up and down) imposed by driven equipment.

- E. Vertical motors shall preferably have oil-lubricated, top and bottom bearings.

- F. Vertical motor bases shall be NEMA Type P.

- G. Provide vertical motors with a positive, non-reversing, corrosion-resistant ("anti-ratchet") mechanism.

- H. Provide vertical motors with fan-end splash shields.

2.10 SLIDING BASE AND SOLE PLATE REQUIREMENTS (NOT REQUIRED)

- A. Motors for adjustable belt and chain drives, 1 hp larger, shall be provided with slide rails, or a double-screw adjusting heavy duty sliding based. Fractional horsepower motors shall have slotted holes.

LOW VOLTAGE ELECTRIC MOTORS

Fabricate sliding base from heavy steel to withstand vibration and corrosive environment and paint it the same color with the same paint system as the motor.

- B. Mating surfaces shall be ± 0.0002 in./ft and finished to 250 microinches, and shall be protected during shipping.
- C. Motors without sliding bases and that will not be directly mounted on equipment bases shall be equipped with sole plates. Sole plates shall be set into Owner's foundation and the motor shall be mounted onto the plate.

2.11 ROTOR BALANCING AND VIBRATION

- A. Balance motor rotors dynamically according to NEMA standards. Depositing weld metal, solder and the like on the rotor to effect a balance will not be acceptable. Remove parent metal to achieve balance without affecting the structural strength of the rotor. Chiseling or sawing parent metal is prohibited.
- B. Measure vibration in all directions with the motor running uncoupled at no load, normal voltage and frequency, and at each speed of the operating range. Motor vibration shall not exceed the total amplitude, peak-to-peak values given in ANSI/NEMA MG 1-12.05A as measured in accordance with ANSI/NEMA MG 1-12.07.

2.12 NAMEPLATES

- A. Fasten motor stainless steel nameplates securely to the motor with stainless steel screws. Nameplates shall include as a minimum the information required by ANSI/NEMA MG 1-16.61.

2.13 FINISH

- A. Motors shall be primed and finished using the motor manufacturer's standard epoxy painting system.
- B. Cover internal surfaces, e.g., shaft, rotor, stator, and other similar components, with a corrosion-resistant coating of epoxy or equal material for increased life.

2.14 NOISE LEVELS

- A. Determine motor noise level in accordance with IEEE 85. Levels or noise generated by a motor shall not exceed 85 dbA at a distance of 1 m/3.3 ft.

- B. Noise level requirements may be also covered by a separate noise requirements specification included with the driven equipment specification.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify dimensions of motor foundation with sole plates or slide rails in place.

3.02 INSTALLATION

- A. Install the motor in accordance with the Manufacturer's published instructions using the necessary tools and instrument to ensure proper fit and alignment with the driven machine.

- B. Before coupling up with the driven machine, the following work should be performed.

1. Test the motor winding insulation resistance in accordance with IEEE 43.
2. Terminate cables to the motor leads.
3. Energize motor momentarily to check rotation.
4. Check shaft of driven machine to ensure free movement.

- C. Couple motor up with driven machine.

- D. Record motor nameplate data.

3.02 IDENTIFICATION

- A. See Specification 16195.

END OF SECTION

LOW VOLTAGE ELECTRIC MOTORS

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Section 16195

ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specification for electrical identification including:

1. Nameplates and labels
2. Wire and cable markers
3. Conduit markers
4. Cable tray markers
5. Underground warning tape
6. Warning labels

1.02 REFERENCES

A. American National Standards Institute/National Fire Protection Association (ANSI/NFPA)

1. No. 70 - National Electrical Code (NEC)
 - a. Article 110 - Requirements for Electrical Installation
 - b. Article 430 - Transformers and Transformer Vaults

B. City of Houston Building Code

C. Other applicable Codes and Standards as referenced in other Sections.

D. Underwriters Laboratories. U.L. Standards No. 224 - Extruded Insulated Tubing

1.03 SUBMITTALS

A. Submit the following under the provisions of Section 01330 Submittal Procedure:

1. Manufacturer's cut sheets and catalog data

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by GAI*

ELECTRICAL IDENTIFICATION

2. Description of materials used
3. Label or nameplate dimensions
4. Engraving or imprint legends
5. Instruction for handling and storage
6. Installation instructions

1.04 DELIVERY, STORAGE AND HANDLING

- A. Pack materials to permit ease of handling and to provide protection from damage during shipping, handling and storage.

PART 2 P R O D U C T S

2.01 ACCEPTABLE MANUFACTURERS

- A. Almetek Industries Incorporated
- B. Brady U.S.A. Incorporated
- C. Ideal Electric Company
- D. Raychem Corporation
- E. 3M Electrical Products Division
- F. Thomas & Bett
- G. Tyton Corporation

2.02 MATERIALS AND EQUIPMENT

- A. Nameplates and Labels
 1. Provide an identification tag for each item of electrical and instrumentation equipment showing its item number and service or application. Use the description shown on the electrical Drawings.
 2. For nameplates, use 3-ply phenolic material engraved to show black lettering on a white background. Size the nameplates approximately 1 inch wide and 3 inches long for 3 lines of 3/16 inch - 16 letters with a 0.8 condensed factor.

3. Generally, provide large pieces of equipment with engraved nameplates; provide additional nameplates at pushbuttons and other local devices; as detailed. Provide identification for all other electrical and instrumentation equipment, devices, or enclosures, such as MCC's, panelboards, disconnect switches, capacitors, relays, and dedicated receptacles not furnished with readily noticeable tag, nameplates, or other means of identification. Provide fault current nameplate per NEC requirements.
4. Install nameplates on the front cover of transformers stating the transformer service location number or identification number, the panelboard or device served, and main breaker feeding the transformer (MCC No. and compartment), and the drawing number on which the transformer schematic is shown.
5. Furnish equipment, such as motor starters, safety switches, welding receptacles and circuit breakers, with 1" x 3" plastic nameplates stating description of item served.
6. Provide nameplates for motors giving the driven equipment description, the service location number, and the MCC number with compartment number when applicable. Nameplates will normally be mounted adjacent to the motor at the motor pushbutton when one is furnished.
7. Install nameplates on the outside and inside of doors to circuit breaker panelboards (i.e., lighting, instrument or receptacle panels). State the panelboard name, the drawing number on which the panelboard schedule shows, and the main breaker feeding the panel (MCC No. and compartment).
8. Type panelboard directories and insert them inside the panelboard doors. Text shall be 12pt- Arial font.
9. Place a large nameplate no less than 3"x5" on control panels, relay panels, junction boxes, or enclosures with electrical devices mounted inside or on the outside of the enclosure indicating the purpose of the cabinet.
10. Provide a nameplate on MCC motor starter doors duplicating motor nameplate data.

B. Wire and Cable Markers

1. Use pre-printed tubular heat-shrink type wire and cable markers at each end of all conductors.

ELECTRICAL IDENTIFICATION

2. Select markers manufactured so that the heat-shrink process makes the imprint permanent and solvent-resistant.
3. Use markers that are self-extinguishing, conforming to U.L. Standard No. 224 for print performance, heat shock, and flammability.
4. Provide marker material that is flexible, radiation cross-linked polyolefin with 3 to 1 shrink ratio, rated 600 volts, and white in color.

C. Conduit Markers

1. Provide conduit markers made of stainless steel tags approximately 2 inches x 1 inch x 19 gage.
2. Stamp the caption on the tag and have it black filled.
3. Punch tags for tie fasteners. Fasten tags to the conduits with stainless steel braided wire.

D. Cable Tray Markers

1. For high visibility and contrast, use cable tray markers that are yellow with black legend.
2. Use markers made of vinyl impregnated cloth, suitable for exposure to corrosive, wet, and abrasive environment.
3. Make markers of pre-cut individual letters or numbers with pressure sensitive adhesive backing.
4. Size legend characters to 4 inches high on a total marker height of approximately 5 inches, suitable for applying to 6-inch side rails of a cable tray.

E. Underground Warning Tape

1. Provide warning tape made of 4 mil thick polyolefin film, 3 inches wide, suitable for direct burial and resistant to alkalis, acids, and other common soil substances.
2. Use red tape with black legend printed in permanent ink.

F. Warning Labels

1. Place OSHA safety labels on enclosures and boxes 100 cubic

- D. Use equipment which is UL listed and properly UL labeled. Equipment shall be new, and of a design and construction to suit the application in accordance with accepted industry standards and LPI, UL, NFPA, and NEC code requirements.

PART 3 EXECUTION

3.01 PREPARATION

- A. The Contractor is responsible for the following coordination with the building contractors:
 - 1. The lightning protection installer shall install a correct, neat and unobtrusive installation in cooperation with other trades.
 - 2. The roofing contractor shall seal and flash protection roof lightning penetrations conforming to the roof manufacturer's recommendations. However, the lightning protection contractor shall designate locations of through roofs and submit details of through roof penetrations, as required.
 - 3. Should the roofing manufacturer require any special walk pads, membrane patches or pavers under the components of the lightning protection system, the lightning protection installer shall install such items with the roofing materials (patches, pads, pavers, adhesive) supplied by the roofing manufacturer at no additional cost to the lightning protection installer.
 - 4. The roofing contractor shall instruct the lightning protection installer of the proper installation procedures of the roof pads, patches, and pavers, if required.

3.02 INSTALLATION

- A. Have the system installed by an experienced installation company that is UL listed, a member of the Lightning Protection Institute and an employer of Certified Master Installers of lightning protection systems.
- B. A Certified Master Installer shall directly supervise the work. Provide and stall a complete conductor network at the roof and include air terminals, connectors, splicers, bonds, copper down leads, and proper ground terminals.
- C. Use copper down lead conductors even when aluminum is required on the roof. Do not bring down lead conductors in conduit directly through the roof. Use through roof assemblies with solid brass or stainless steel rods for this

- inches or more containing electrical equipment or terminations.
2. Provide OSHA color codes for the labels. Use labels made from 4 mil vinyl with pressure sensitive adhesive backing.
 3. The warning label caption is DANGER - 480 VOLTS or as indicated on the drawings
 4. Size labels either 5 inches x 3-1/2 inches or 10 inches x 7 inches, as indicated on the Drawings.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces where adhesive labels will be applied.
- B. Drill holes for nameplates to be fastened with stainless screws.
- C. Prepare the cable ends for termination and conductor markings.
- D. Identify conduits at terminating points and select tags accordingly.

3.02 INSTALLATION

- A. Install nameplates and labels in accordance with the manufacturer's instructions and the Drawings.
- B. Apply wire and cable markers in accordance with manufacturer's instructions using a heat gun with properly sized nozzle for the application. Tag the wires at both ends with the same notation.
- C. Tag conduits at junction boxes, pull boxes, and at other termination points.
- D. Identify cable trays at the time of installation with the alphanumeric number shown on the Drawings. Label cable trays on the outside rail. Place the tray identifier at each point where the tray designation changes and at 200 foot intervals in between, but not less than two per run.
- E. Identify underground conduits, cables, or duct banks using the underground warning tape. The underground grounding grid, including the laterals. Also use underground warning tape. Install one tape per trench at 12 inches below grade or as indicated on the Drawings. For wide trenches or duct banks, install one warning tape per 24 inch width.

ELECTRICAL IDENTIFICATION

- F. Apply the 5 inches by 3-1/2 inches warning labels to disconnect switches, panelboards, terminal boxes, and similar devices in accordance with manufacturer's instruction and the Drawings. Apply the 10 inches x 7 inches warning labels to larger control panel enclosures, motor control centers, and to entrance doors to buildings containing electrical power and control equipment.

END OF SECTION

SECTION 16290

SURGE PROTECTION DEVICES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install surge protective devices (SPDs) in the MCC/power panel, control panels and field devices.
2. Provide surge protection devices to protect field instruments and equipment from the effects of transient surges caused by lightning and other electrical sources.
3. SPDs shall be installed at the following locations:
 - a. On 480 VAC power and neutral connections at the MCC or power panels
 - b. On 120 VAC, 60Hz power connections to control panels.
 - c. On all analog signals at the control panel. Include surge protection at 24 VDC loop powered field instruments for wiring distances greater than 75 feet from the control panel. Include surge protection on all four-wire, 120 VAC field instruments.
 - d. On all discrete signals that have portions of interconnecting wiring located outside of protected buildings.
 - e. On all copper data lines that have portions of interconnecting wiring located outside of protected buildings

B. Related Sections:

1. Section 17320: Control Panels and Enclosures.
2. Division 16: Electrical.

1.02 QUALITY ASSURANCE

A. Standards, Codes and Regulations:

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by GAI*

SURGE PROTECTION DEVICES

1. Surge protective devices and the installation and interconnection of the devices shall comply with applicable provisions of the following standards, codes and regulations:
 - a. National Fire Protection Association 79, Annex "D" Standards, (NFPA).
 - b. National Electrical Code, (NEC).
 - c. National Electrical Manufacturer's Association Standards, (NEMA).
 - d. UL 1449 Third Edition, Standard for Safety Surge Protective Devices (SPDs).
 - e. UL 497B, Protectors for Data Communications and Fire-Alarm circuits.
 - f. International Electrotechnical Commission (IEC).
 - g. Institute of Electrical and Electronics Engineers (IEEE).
 - h. State and Local code requirements.
 - i. Where any conflict arises between codes or standards, the more stringent requirement shall apply.

PART 2 P R O D U C T S

2.01 SPD - GENERAL

- A. Connect and ground in accordance with surge protection device manufacturer's instructions. SPDs shall use a separate path to building ground; the equipment safety ground is not to be used as a transient ground path.
- B. SPDs shall be installed as close as practical to the protected equipment, panel, or switchboards to minimize connecting wire lead lengths.
- C. All control panel SPDs shall be DIN-rail mountable and capable of being monitored by direct visual means and have remote indication for fault indication to a local monitoring and control system.
- D. All control panel SPDs shall be pluggable for easy removal to facilitate testing to ensure proper protection levels. Removal shall not disrupt operation of protected circuits.

- E. MOV based suppression products rated for use above 110 VAC, 60Hz, 95 percent humidity, shall incorporate a thermally sensitive device to remove the metal oxide varistor (MOV) from service should the event of severe overheating occur.
- F. The surge protection devices shall be used as the interface terminal blocks when applicable.

2.02 SPD - 480 VAC POWER

- A. General: Provide surge protection for 3-phase 480 VAC wye power connections. Include circuit breaker in series with each device to facilitate device removal and testing.
- B. Features:
 - 1. Suppression: Metal oxide varistors (MOVs) and gas-filled surge arresters.
 - 2. Protection level Up (core-neutral): ≤ 1.6 kV.
 - 3. Protection level Up (core-ground): ≤ 1.75 kV.
 - 4. Protection level Up (neutral-ground): ≤ 1.5 kV.
 - 5. Nominal discharge surge current (8/20 μ s): 20 kA.
 - 6. Maximum discharge surge current (8/20 μ s): 40 kA.
 - 7. Response time (core-neutral): ≤ 25 ns.
 - 8. Response time (core-ground): ≤ 100 ns.
 - 9. Operating temperature of -40 °C to 80 °C.
- C. Product and manufacturer:
 - 1. Phoenix Contact, VAL-MS 320/3+1.
 - 2. Erico, TDS350TT277
 - 3. Dehn, DG MU 3PY 480 4W+G
 - 4. Or approved equal.

2.03 SPD - 120 VAC POWER

SURGE PROTECTION DEVICES

- A. General: Provide modular, pluggable surge protective device of the incoming power feed to the control panel.

- B. Features:
 - 1. Suppression: Metal oxide varistors (MOVs) and gas-filled surge arresters.
 - 2. Maximum Continuous Operating Voltage: 150V.
 - 3. Nominal load current In: 26 A.
 - 4. Protection level Up (L-N): 620 V.
 - 5. Protection level Up (L-PE): 850 V.
 - 6. Protection level Up (N-PE): 850 V.
 - 7. Nominal discharge surge current (8/20 μ s): 2.5 kA.
 - 8. Response time: < 25 ns (L-N)
 - 9. Operating temperature of -40 °C to 85 °C.

- C. Product and manufacturer:
 - 1. Phoenix Contact, MAINS-PLUGTRAB PT 2-PE/S-120AC-ST.
 - 2. Erico, TDS1301TR150
 - 3. Dehn, DR M 2P 150
 - 4. Or approved equal.

2.04 SPD – 24 VDC ANALOG – CONTROL PANEL

- A. General: Surge protection device (SPD) at the control panel for 24 VDC power connections to field instruments. SPD shall be pluggable, modular and able to be tested.

- B. Features:
 - 1. Suppression: Gas-filled surge arrester and silicon avalanche diode.
 - 2. Maximum Continuous Operating Voltage: 28 VDC.
 - 3. Nominal current In: 450 mA.

4. Protection level Up (core-core): ≤ 70 V (1 kV/500 A).
 5. Protection level Up (core-ground): ≤ 450 V (1 kV/5 kA).
 6. Resistance per path: 2.2 ohms.
 7. Nominal discharge surge current (8/20 μ s): 10 kA.
 8. Total surge current (8/20 μ s): 20 kA.
 9. Response time (core-core): ≤ 1 ns
 10. Response time (core-ground): ≤ 100 ns
 11. Capable of being monitored by head-end module and LED indicators for status.
 12. Operating temperature of -40 °C to 85 °C.
- C. Monitoring Module Features:
1. Communicate status and provide power to SPD LEDs via TBUS connector on DIN rail.
 2. Nominal Operating Voltage: 28 VDC (20 VDC – 30 VDC).
 3. Provide two NC contacts for status of overload and performance limit reached of connected SPDs.
 4. Capable of monitoring status of 28 SPDs.
 5. Provide ON/OFF switch for SPD LED lights.
- D. Product and manufacturer:
1. Phoenix Contact, MCR-PLUGTRAB PT 1x2-24DC-ST.
 2. Erico, UTB30SP
 3. Dehn, BXT ML4 BE 24
 4. Or approved equal.

2.05 SPD – DISCRETE SURGE PROTECTION – 24 VDC

SURGE PROTECTION DEVICES

- A. General: Surge protection at the control panel for 24 VDC discrete signal connections. SPD shall be pluggable, modular and able to be tested.

- B. Features:
 - 1. Suppression: Gas-filled surge arrester and silicon avalanche diode.
 - 2. Maximum Continuous Operating Voltage: 28 VDC.
 - 3. Nominal current In: 300 mA.
 - 4. Protection level Up (core-ground): ≤ 60 V (1 kV/500 A)
 - 5. Resistance in series: 4.7 ohms.
 - 6. Nominal discharge surge current (8/20 μ s): 10 kA.
 - 7. Total surge current (8/20 μ s): 20 kA.
 - 8. Response time (core-ground): ≤ 1 ns
 - 9. Operating temperature of -40 °C to 85 °C.
 - 10. Capable of being monitored by head-end module and LED indicators for status.

- C. Monitoring Module Features:
 - 1. Communicate status and provide power to SPD LEDs via TBUS connector on DIN rail.
 - 2. Nominal Operating Voltage: 28 VDC (20 VDC – 30 VDC).
 - 3. Provide two NC contacts for status of overload and performance limit reached of connected SPDs.
 - 4. Capable of monitoring status of 28 SPDs.
 - 5. Provide ON/OFF switch for SPD LED lights.

- D. Product and manufacturer:
 - 1. Phoenix Contact, MCR-PLUGTRAB PT 2x1-24DC-ST
 - 2. Erico, UTB30SP
 - 3. Dehn, BXT ML4 BD 24

4. Or approved equal.

2.06 SPD – DISCRETE SURGE PROTECTION – 120 VAC

- A. General: Surge protection at the control panel for 120 VAC discrete signal connections. SPD shall be pluggable, modular and able to be tested.

- B. Features:

1. Suppression: Metal oxide varistors.
2. Maximum Continuous Operating Voltage: 150 VAC.
3. Nominal current In: 26 amps.
4. Protection level Up (Core-ground): ≤ 550 V.
5. Nominal discharge surge current (8/20 μ s): 2.5 kA.
6. Total surge current (8/20 μ s): 5 kA.
7. Response time (core-ground): ≤ 25 ns
8. Operating temperature of -40 °C to 85 °C.

- C. Product and manufacturer:

1. Phoenix Contact, MCR-PLUGTRAB PT 2x1VA-120AC-ST.
2. Erico, UTB110DP
3. Dehn, BXT ML4 BE 180
4. Or approved equal.

2.07 SPD – 24 VDC POWER/ANALOG – FIELD DEVICE

- A. General: Surge protection at the field device for 24 VDC power connections.

- B. Features:

1. Suppression: Gas-filled surge arrester and silicon avalanche diode.
2. Maximum Continuous Operating Voltage: 36 VDC.
3. Nominal current In: 450 mA.

SURGE PROTECTION DEVICES

4. Protection level Up (core-core): ≤ 65 V.
5. Protection level Up (core-ground): ≤ 1.2 kV (C2- 10 kV/5 kA).
6. Nominal discharge surge current (8/20 μ s) (core-ground): 10 kA.
7. Total surge current (8/20 μ s): 20 kA.
8. Core to core response time: < 1 ns.
9. Core to ground response time: < 100 ns
10. Operating temperature of -25 °C to 80 °C.
11. Material and mounting: High grade steel with $\frac{1}{2}$ inch NPT.

C. Product and manufacturer:

1. Phoenix Contact, SURGETRAB, S-PT-EX-24DC.
2. Erico, RTP3034
3. Dehn, BXT ML4 BE 36
4. Or approved equal.

2.08 SPD – 120 VAC POWER/24 VDC SIGNAL – FIELD DEVICE

A. General: Surge protection at the field device to protect the 120 VAC power and 24 VDC analog signal. Surge protection to be provided in a NEMA 4X enclosure.

B. 120 VAC Power Surge Features:

1. Suppression: Metal oxide varistors (MOVs) and gas-filled surge arresters.
2. Maximum Continuous Operating Voltage: 150V.
3. Nominal load current In: 26 A.
4. Protection level Up (L-N): 620 V.
5. Protection level Up (L-PE): 850 V.
6. Protection level Up (N-PE): 850 V.
7. Nominal discharge surge current (8/20 μ s): 2.5 kA.

8. Response time: < 25 ns (L-N)
 9. Operating temperature of -40 °C to 85 °C.
- C. 24 VDC Signal Surge Features:
1. Suppression: Gas-filled surge arrester and silicon avalanche diode.
 2. Maximum Continuous Operating Voltage: 28 VDC.
 3. Nominal current In: 450 mA.
 4. Protection level Up (core-core): ≤ 70 V.
 5. Protection level Up (core-ground): ≤ 450 V.
 6. Resistance per path: 2.2 ohms.
 7. Nominal discharge surge current (8/20 μ s): 10 kA.
 8. Total surge current (8/20 μ s): 20 kA.
 9. Response time (core-core): ≤ 1 ns
 10. Response time (core-ground): ≤ 100 ns
 11. Operating temperature of -40 °C to 85 °C.
- D. Product and manufacturer:
1. Phoenix Contact, BOXTRAB – BXT-N4X 4-WIRE.
 2. Erico, MWE and TDS1301TR150
 3. Dehn, 999.990-01
 4. Or approved equal.

2.09 SPD – DATA SURGE PROTECTION - ETHERNET

- A. General: Surge protection to protect CAT-5/6 Ethernet data signal. Provide attachment plug for DIN-rail mounting. Connection method to device by RJ45 plug.
- B. Features:

SURGE PROTECTION DEVICES

1. Suppression: Gas-filled surge arrester and diodes.
2. Maximum Continuous Operating Voltage (core-ground): ≤ 180 VDC.
3. Nominal current I_n : ≤ 1.5 A.
4. Protection level U_p (core-core): ≤ 9 V (1 kV/25A)
5. Protection level U_p (core-core): ≤ 100 V (1 kV/25A - PoE)
6. Protection level U_p (core-earth): ≤ 600 V.
7. Nominal discharge surge current (8/20 μ s) (core-ground): 2 kA, per signal pair.
8. Total surge current (8/20 μ s): 10 kA.
9. Response time (core-core): ≤ 1 ns.
10. Response time (core-ground): ≤ 100 ns
11. Operating temperature of -40 °C to 70 °C.

C. Product and manufacturer:

1. Phoenix Contact, DT-LAN-CAT.6.
2. Erico, LANRJ45C6
3. Dehn, DPA M CLE RJ45B 48
4. Or approved equal.

2.010 SPD – DATA SURGE PROTECTION – RS-485

A. General: Surge protection to protect RS-485 connection. Provide attachment plug for DIN-rail mounting. Connection method to device by 9-position D-SUB connector.

B. Features:

1. Suppression: Gas-filled surge arrester and diodes.
2. Maximum Continuous Operating Voltage: 12 VDC.
3. Nominal current I_n : ≤ 380 mA.
4. Protection level U_p (core-core): ≤ 40 V (5 kA)

5. Protection level Up (core-ground): ≤ 750 V (5 kA).
6. Resistance in series: 3.3 ohms.
7. Nominal discharge surge current (8/20 μ s) (core-ground): ≤ 5 kA.
8. Total surge current (8/20 μ s): 10 kA.
9. Response time (core-core): ≤ 100 ns.
10. Response time (core-ground): ≤ 100 ns
11. Operating temperature of -40 °C to 85 °C.

C. Product and manufacturer:

1. Phoenix Contact, DT-UFB-485/BS.
2. Erico, DEPRS42299D
3. Dehn, BXT ML4 BD HF 5
4. Or approved equal.

2.011 SPD – DEVICE TESTER

A. General: Provide device tester for pluggable surge protective devices in convenient carrying case.

B. Features:

1. Barcode scanner or keypad for entering information on SPD.
2. Operating Voltage: 100 – 240 VAC.
3. Provide all test sockets for SPDs used on the project.
4. Provides documentation of test results.

C. Product and manufacturer:

1. Phoenix Contact, CHECKMASTER.
2. Erico, MGA TESTER
3. Dehn, DRC LC M3+

SURGE PROTECTION DEVICES

4. Or approved equal.

2.012 SPARE PARTS

- A. Provide the following control system network component spare parts:
 1. One per five of each type of surge protective device; minimum of one of each type of surge protective device.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The installation shall follow the SPD manufacturer's recommended installation practices and comply with all applicable codes.
- B. Coordinate the installation of the surge protection device with the installation of the equipment being protected. The surge protection device shall be installed as close as practical to or within the equipment being protected.
- C. Conductor length between suppressor and connection point shall be as short and as straight as possible.
- D. Upon completion of installation, provide the services of a factory-certified local service technician to perform start-up testing. Record test results and compare to factory testing to confirm proper operation of equipment. Submit test results with operation and maintenance manuals.

END OF SECTION

Section 16402

UNDERGROUND DUCT BANKS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Underground electrical duct banks.

1.02 REFERENCES

- A. National Fire Protection Association (NFPA): No. 70 - National Electrical Code (NEC) Appendix B.

1.03 SUBMITTALS

- A. Catalog cut sheets of the ducts and spacers.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Have duct spacers and associated hardware packed and crated to avoid damage during shipment and handling.
- B. Clearly mark packages or crates stating that the material is for electrical duct banks only.

PART 2 P R O D U C T S

2.01 ACCEPTABLE MANUFACTURERS

- A. Thomas and Betts.
- B. Underground Devices Inc.
- C. Walker Division, Butler Manufacturing Company.

2.02 MATERIALS AND EQUIPMENT

- A. Conduit. Construct ducts using schedule 80 rigid PVC conduit. Refer to Section 16111 - Conduit, Fittings and Bodies.
- B. Spacers. Secure conduit with non-magnetic, universal, interlocking-type spacers for both horizontal and vertical duct arrangements.
- C. Concrete. Use steel reinforced, red concrete as duct encasement. Refer to Section 03100 Concrete Formwork.

UNDERGROUND DUCT BANKS

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify from Drawings and field survey that the location of ductbanks does not interfere with any existing or new underground facilities.
- B. Verify that materials are on site in proper condition and that sufficient quantity is on hand for the work.
- C. Verify that trenches are in the correct places and prepared with sufficient depth and width to accommodate the duct banks, reinforcing rod, and concrete.
- D. Be prepared for inspection of the duct banks before reinforcing rod is installed.
- E. Before pouring concrete, verify that the ducts are free of debris and properly installed in the support and spacer systems and that the ducts are properly fitted together and firmly held in place by the hold down hardware.
- F. Provide 24-hour notice to Project Manager, Wastewater Inspectors and the Local Code Inspector for cover-up inspection before pouring electrical conduit ductbanks.

3.02 INSTALLATION

- A. Use the size and types of conduit as indicated on the Drawings for the various duct banks required for the project.
- B. Make duct bank installations and penetrations through foundation walls watertight.
- C. Assemble duct banks using non-magnetic saddles, spacers and separators. Position separators to provide 2-inch minimum concrete separation between the outer surfaces of the conduits.
- D. Provide a 3-inch minimum concrete covering on both sides, top and bottom of concrete envelopes around conduits. Add red dye at the rate of 10 pounds per cubic yard to concrete used for envelopes for easy identification during subsequent excavation.
- E. Firmly fix ducts in place during pouring of concrete. Carefully spade and vibrate the concrete to ensure filling of spaces between ducts.
- F. Make bends with sweeps of radius not less than 6 times the smallest diameter of the raceway.

- G. Make a transition from non-metallic to PVC-coated metallic rigid aluminum conduit where duct banks enter structures or turn upward for continuation above grade.
- H. Make bends of 30 degrees or more using PVC coated metallic rigid aluminum conduit.
- I. Reinforce duct banks throughout, where indicated on the Drawings.
 - 1. Unless otherwise noted on the Drawings, reinforce with No. 5 longitudinal steel bars placed at each corner and along each face at a maximum parallel spacing of 12 inches on centers, and No. 5 tie-bars transversely placed at 18-inch maximum longitudinal intervals.
 - 2. Maintain a maximum clearance of 2 inches from bars to the edge of the concrete encasement.
- J. Where ducts enter structures such as handholes, manholes, pullboxes, or buildings, terminate the ducts in suitable end bells, insulated L-bushings, Meyers hubs or couplings on steel conduits. Tag conduit entering pull boxes with stamped, stainless steel tags. Identify as designated in cable and conduit schedule.
- K. Do not backfill with material containing large rock, paving materials, cinders, large or sharply angular substances, corrosive material, or other materials which can damage or contribute to corrosion of ducts or prevent adequate compaction of fill.
- L. Install a tinned bare stranded #4/0 AWG copper duct bank ground in each duct bank envelope. Make ground electrically continuous throughout the entire duct bank system. Connect ground to switchgear and MCC ground buses and to steel conduit extensions of the underground duct system.
- M. After completion of the duct bank and prior to pulling cable, pull a mandrel, not less than 12 inches long and with a cross section approximately one-fourth inch less than the inside cross section of the duct, through each duct. Then pull a rag swab or sponge through to remove any particles of earth, sand or gravel that may have been left in the duct. Repull the rag or sponge swab until the swab emerges clean.
- N. Use hemp rope to pull conductors into PVC conduit. Do not use nylon or wire cable for this purpose.

UNDERGROUND DUCT BANKS

- O. Install a warning ribbon approximately 12 inches below finished grade over underground duct banks. Refer to Section 16195 - Electrical Identification.
- P. For manholes and pull boxes below grade, install wire racks to support cables properly around the perimeter and keep them dry.
- Q. For manholes and pull boxes below grade, construct a french drain, or other drainage as detailed on the Drawings.

END OF SECTION

Section 16410

LOW VOLTAGE POWER FACTOR CORRECTION CAPACITORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specifications for low voltage power factor correction capacitors.

1.02 REFERENCES

- A. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA)
 - 1. NEMA CP-1: Shunt Capacitors
 - 2. NEMA ICS-2: Industrial Control Devices, Controllers and Assemblies
- B. American National Standards Institute/National Fire Protection Association (ANSI/NFPA): NFPA No. 70 - National Electrical Code (NEC) Article 460 - Capacitors.
- C. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE): Standard No. 18 - Standard for Shunt Power Capacitors.
- D. Underwriters Laboratories, Inc. (UL): UL 810 - Capacitors.
- E. Power factor correction system shall comply with Centerpoint standard for harmonic distortion.

1.03 SUBMITTALS

- A. Submit the following under provisions of Section 01330 – Submittal Procedures:
 - 1. Mounting dimensions and instructions
 - 2. Equipment weights
 - 3. Catalog data
 - 4. Electrical schematics and wiring diagrams for control devices

5. Operating instructions for controls

1.04 QUALITY ASSURANCE

A. Tests

1. Perform tests in accordance with ANSI/NEMA CP-1. Each capacitor shall be subjected to manufacturing testing as described in ANSI/UL 810. Have test or inspections performed and evaluated by qualified personnel. Document deficiencies observed during the testing process and correct them prior to shipment.
2. Tests required include: short-time over voltage test, capacitance test, leak test and dissipation factor test.
3. Run a functional test on factory assembled automatic units.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Have capacitors packed and crated to permit ease of handling and to provide protection from damage during shipping, handling and storage.

PART 2 P R O D U C T S

2.01 ACCEPTABLE MANUFACTURERS

- A. ABB Power T&D Company, Inc.
- B. ASC Industries
- C. Eaton/ Cutler Hammer.
- D. General Electric Company
- E. Schneider Electric

2.02 MATERIALS AND EQUIPMENT

A. Capacitor Requirements

1. The capacitors shall provide power factor correction for individual motors 15 horsepower and above in the system by connecting each capacitor to the load side of the respective motor starter, or automatically switching capacitor banks on and off in accordance with the need for reactive power. See Drawings and one-line diagrams for details.

2. Use capacitors meeting the requirements stipulated in NEMA CP-1 and IEEE Standard No. 18.
3. The capacitor total losses shall not exceed 0.5 W per kVAR.
4. Select capacitors with permanently connected discharge resistors in full compliance with NEC Article 460-6(a) and (b).
5. Use capacitors which are the fused, fixed-type with multiple cells with dry-type dielectric enclosed in an anti-corrosion unpainted enclosure.
6. When individual motor circuits are equipped with power factor correction capacitors, connect the capacitors to the circuit between the contactor and the overload relay so as not to affect the true value of the motor current going through the overload relay heater coils.
7. Provide necessary anti-corrosion mounting brackets and hardware with the capacitors.
8. When called for on the one-line diagrams, provide the power factor correction by an automatic capacitor bank.
9. Connect the capacitor bank to the main power supply bus immediately down-stream from the ammeter and voltmeter in the motor control center.
10. Select individual capacitors as described for the individual motor power factor correction capacitor.
11. Use a capacitor bank with a modular design to allow for expansion by adding capacitor units and control devices.
12. Mount capacitors and control system in an enclosure suitable for the environment and as specified in Section 16160 - Cabinets and Enclosures.
 - a. If installed outside, provide a NEMA 3 gasketed enclosure.
 - b. If installed inside a building, provide a NEMA 12 enclosure.
 - c. Mount capacitors on wall above indoor motor control centers.
 - d. If a motor control center is part of the plant design, install controls for the automatic power factor correction capacitors in a motor control center section.

- B. Automatic Power Factor Control: Where specified, provide controls to permit an operator to select a target power factor adjustable to any value between 0.95 leading and 0.80 lagging. The controls continuously sense the power factor on the circuit being corrected and, when it differs from the target setting for more than 10 seconds, operate a contactor to switch a capacitor bank into or out of the circuit. Contactors are opened or closed as required to bring the corrected circuit power factor closer to the target setting. Only one capacitor bank is switched at a time.
- C. Controls. The controls for the automatic power factor correction shall comply with NEMA ICS-2 with quantities, ratings, mounting provisions and sensing, and power connections as shown on the one-line diagrams. System features and components shall include:
1. Basic control system: solid-state microprocessor-based.
 2. Three-pole 600-volt rated contactors for repetitive high-inrush-switching duty presented by capacitor loading.
 3. Fuses or circuit breakers for protection of wiring, contactors and capacitors.
 4. Air-core-type inductors mechanically braced to withstand the maximum fault current available at the point of application may be installed in the capacitor circuit to limit switching surges to within contactor ratings.
 5. Indicating lights designating energized capacitor banks.
 6. The power bus, when required, shall be tin plated copper and braced for available fault current.
 7. Interlock enclosure doors to de-energize capacitors when doors are opened.
 8. A switchboard type power factor meter with 0.5 lagging to 0.5 leading and plus or minus one percent accuracy.
 9. A main circuit breaker operable from outside the enclosure which can de-energize the entire system inside the enclosure. Arrange breaker for pad-locking.
 10. Capacitor failure alarm relay with one form C contact for connection by City.

PART 3 EXECUTION

3.01 PREPARATION

- A. Factory Assembled Unit. Verify dimensions of the housekeeping pad and the embedded leveling channels and conduit stub-ups if applicable.
- B. Individual Capacitor for Each Motor. Verify dimensions of the capacitor mounting rack to ensure proper fit and accessibility for wiring and maintenance.
- C. Controls in Motor Control Center - Capacitors separately mounted. Verify content of Motor Control Center section to ensure correct power and control devices and wiring.

3.02 INSTALLATION

- A. Install equipment and wire up in accordance with the manufacturer's published instructions.
- B. Torque bus bar bolts and cable connections to manufacturer's recommendations and tighten nuts and bolts on steel enclosures to ensure structural integrity.
- C. Locate capacitors to allow adequate ventilation around the enclosures.

END OF SECTION

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Section 16461

DRY-TYPE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specifications for dry-type transformers for the following applications:
 - 1. Motor drive isolation
 - 2. Shielded isolation
 - 3. Non-linear loads
 - 4. General purpose

1.02 REFERENCES

- A. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA)
 - 1. ANSI No. C89.2: Transformers
 - 2. NEMA ST 1: Specialty Transformers
 - 3. NEMA ST-20: Dry-Type Transformers for General Applications
- B. Underwriters Laboratories (UL): UL 506 - Standard for Safety Specialty Transformers.
- C. American National Standards Institute/National Fire Protection Association (ANSI/NFPA): NFPA No. 70 -National Electrical Code (NEC); Article 450 - Transformers and Transformer Vaults.

1.03 SUBMITTALS

- A. Submit the following under provisions of Section 01330 – Submittal Procedures:
 - 1. Outline dimensions, support points and unit weight.
 - 2. Electrical characteristics, including impedance and tap configuration.
 - 3. Insulation type, rated temperature rise, and total insulation system.

DRY-TYPE TRANSFORMERS

4. Test reports are required for equivalent of supplied transformers 300 KVA and above, indicating losses at 25, 50, 75 and 100 percent rated load and sound levels.
5. Connection diagrams.
6. Catalog data.
7. Operation and maintenance data.

1.04 QUALITY ASSURANCE

- A. Tests. Run manufacturer's test on transformers in accordance with Underwriters Laboratories (U.L.) Standard No. UL-506.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Have transformers individually packed and crated to permit ease of handling and to provide protection from damage during shipping, handling and storage.

PART 2 P R O D U C T S

2.01 ACCEPTABLE MANUFACTURERS

- A. ACME Transformer
- B. Eaton/ Cutler Hammer
- C. General Electric
- D. Hevi-Duty
- E. Schneider Electric

2.02 MATERIALS AND EQUIPMENT

- A. Use dry-type transformers for lighting system or other general purpose applications, motor drive isolation, shielded isolation and non-linear load requirements.
- B. Provide transformers with copper windings.
- C. Select transformers designed and constructed in accordance with NEMA ST-1, NEMA ST-20 and the NEC Article 450.

- D. For applications up to 30 KVA, use transformers that are encapsulated, non-ventilated type with 115 degree C temperature rise and 185 degree C insulation class.
- E. Provide transformers with full capacity winding taps a minimum of two 2-1/2 percent above and two 2-1/2 percent below normal voltage.
- F. For applications of 30KVA and above use transformers that are the drip-proof ventilated type for indoor mounting only.
- G. Use transformers with sound levels in accordance with NEMA ST-20.
- H. Basic impulse level (BIL) shall be 10KV for transformers less than 300 KVA, 30KV for transformers 300KVA and larger.
- I. Ground core and coil assembly to enclosure by means of a visible flexible copper strap.
- J. Provide transformers with lifting eye bolts or brackets.
- K. Provide transformer nameplates of stainless steel, marked in accordance with NEC Article 450-11. Fasten nameplate to the transformers with stainless steel screws or rivets.
- L. Refer to the one-line diagram or the Drawings for transformer size, volt and wire configuration.
- M. Special purpose transformers shall be as follows:
 - 1. Motor drive isolation transformers: designed for 3-phase SCR controlled, variable speed motor voltages with bracing to withstand stresses associated with motor drives.
 - 2. Shielded isolation transformers shall be designed for power inputs to microprocessors and computers that require additional protection from electrical disturbances with the use of grounded electrostatic shielding.
 - 3. Non-linear transformers shall be designed to withstand the heating effects caused by harmonics resulting from non-linear, non-sinusoidal loads. Use K-rated transformers for non-linear loads.

DRY-TYPE TRANSFORMERS

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify dimensions of housekeeping pads or other support structures to ensure proper fit.
- B. Verify raceway and wiring drawings that are prepared for the transformers and check them against the manufacturer's information.
- C. Verify that the protective devices planned for the transformers are in accordance with NEC Article 450.

3.02 INSTALLATION

- A. Install transformers plumb and level and in accordance with manufacturer's instructions and the NEC Article 450.
- B. Use flexible conduit for connection to transformer case. Make conduit connections to side panel of enclosure.
- C. Mount transformers on isolation pads as required to isolate transformer noise from the buildings structure.
- D. Wire transformer primary and secondary in accordance with the nameplate instructions and the designated voltages as shown on the one-line diagram.

END OF SECTION

Section 16480

MOTOR CONTROL CENTER

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specification for low voltage motor control center (MCC).

1.02 REFERENCES

- A. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA)
 - 1. ICS 1: General Standards for Industrial Control and Systems
 - 2. ICS 2: Industrial Control Devices, Controllers and Assemblies
 - 3. ICS 4: Terminal Blocks for Industrial Use
- B. American National Standards Institute/Underwriters Laboratories, Inc. (ANSI/UL)
 - 1. 467: UL Standard for Safety, Grounding and Bonding Equipment
 - 2. 489: UL Standard for Safety, Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
 - 3. 506: UL Standard for Safety, Specialty Transformers
 - 4. 845: UL Standard for Safety, Motor Control Centers
- C. American National Standards Institute/National Fire Protection Association (ANSI/NFPA): 70 National Electrical Code (NEC).

1.03 SUBMITTALS

- A. Submit the following under the provisions of Section 01330 – Submittal Procedures:
 - 1. Outline drawings with elevations
 - 2. Equipment arrangement drawings
 - 3. Anchor bolt location drawings

MOTOR CONTROL CENTER

4. Electrical schematics and wiring diagrams
5. Current, potential, and power transformer curves
6. Electrical fuse/circuit breaker characteristic
7. Equipment performance curves and data
8. Bill of installation/assembly materials
9. Equipment weights
10. Completed manufacturer's data sheets
11. Catalog data
12. Assembly/disassembly sizes and weights
13. Nameplate data
14. Performance/acceptance test report
15. Operation and maintenance data

1.04 QUALITY ASSURANCE

- A. Tests. Perform tests in accordance with ANSI/NEMA ICS 2-322.22. Test each MCC as described in ANSI/UL 845. Make available upon request certified temperature and short-circuit test data, and a certificate of circuit breaker conformance with ANSI C37.16. Have tests and inspections performed and evaluated by qualified personnel. Document and correct deficiencies observed during the testing process prior to shipment.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Upon completion of the manufacture and assembly of the MCC and before crating for shipment, have parts that are disassembled match marked to facilitate installation in the field. Pack and crate parts in such a way to permit ease of handling.
- B. Equip MCC shipping sections with lifting facilities so that may be easily unloaded and handled, either by crane or forklift.
- C. Do not exceed 120 inches in length for shipping sections. Have equipment packed, crated, and rigidly braced to protect it from damage during shipment, handling, and outdoor storage. Make provision to energize the space heater of each shipping section during storage at

the jobsite. Make a connection point readily available without uncrating the equipment and clearly tag each shipping section to locate the connection and identify the electrical service required.

PART 2 P R O D U C T S

2.01 ACCEPTABLE MANUFACTURERS

- A. Allen-Bradley
- B. Eaton/ Cutler Hammer
- C. Powell Electrical
- D. Siemens
- E. Schneider Electric

2.02 MATERIALS AND EQUIPMENT

- F. Design. Provide an MCC with the following design characteristics:
 - 1. The MCC construction and wiring shall be NEMA Class I, Type B as specified in ANSI/NEMA ICS-2-322.08 and ICS-2-322.10. Provide an MCC designed for 3-phase, 60 Hz, 480-Volt service with main horizontal and vertical bus ampacities and short circuit bracing as specified on the one-line diagram. Provide NEMA Class IIB wiring for interconnection wiring as specified on drawings.
 - 2. Furnish an MCC designed to operate in service conditions described in NEMA ICS 1 and as shown on the one-line diagram.
 - 3. Supply motor starters suitable for full voltage starting unless otherwise noted on the one-line diagram.
 - 4. Construct the MCC of one or more vertical sections bolted together to form a free standing assembly, designed to permit future additions, changes, or regrouping of units.
 - 5. Provide motor control units of the combination type, consisting of a motor circuit protector (MCP), a magnetic starter and a control power transformer. Size the MCP and starter in accordance with manufacturer's recommendation for the starter and motor size indicated on the one-line diagram.

MOTOR CONTROL CENTER

6. When power factor correction capacitor is called for, connect its wiring to the line side of the overload relay with a set of fuses, a circuit breaker, or other acceptable means to serve as overload protection for the wiring and capacitor.
 7. Manufacture main breaker (if used) and feeder breakers of the molded case, thermal-magnetic type to be mounted and wired in accordance with ANSI/UL 489.
 8. If called for on the one-line-diagram, locate the lighting panelboard, transformer and transformer feeder breaker in the same vertical section. Supply a transformer with 115 degrees C temperature rise, installed in accordance with ANSI/UL 506.
- G. Construction. Construct the MCC of self-supporting and fully enclosed metal clad section for mounting of motor starters, circuit breakers and necessary accessories including bus bars, control transformers, control switches, ground bus, and control wiring, as specified in this section and shown on the one-line diagram.
- H. Enclosures
1. Construct each MCC enclosure to be fully metal enclosed, dead front, free standing, and NEMA 12 suitable for indoor service as defined in ANSI/UL 845 or NEMA 3R suitable for outdoor installation when indicated on the one-line diagram. Fabricate enclosure of sheet steel not less than 14 gauge with rear and end covers not less than 16 gauge; with adequate strength to withstand stresses imposed by short circuit current, shipping, handling, installation, and operation, without distortion or damage.
 2. Construct frames of the enclosure structure with continuous steel barriers, extending from the front to the rear of each compartment for the controller units, buses and power cables.
 3. Provide enclosures of suitable size for reduced voltage starting auto transformers and associated wiring, if required.
- I. Vertical Sections
1. Make the structure 20 inches deep. Nominal vertical section dimensions are 20 inches wide by 90 inches high. Design each vertical section to accommodate not more than six NEMA Size 1 combination motor control units mounted one above the other in front-mounted arrangement.

2. Provided horizontal wiring space at the top and the bottom of each vertical section, which will line up with adjacent sections to form continuous raceways through the entire length of the MCC. In addition, in standard sections include vertical wireways with hinged doors for unit wiring. Provide grommets at points wiring must cross cut-outs.
 3. Use section structure designed for top or bottom cable entry as indicated on the one-line diagram. Provide adequate ventilation and heating facilities for each section to keep the maximum temperature rise and humidity within the acceptable limits.
- J. Incoming Feed
1. Terminate incoming feeder cables in a main breaker or main lugs. Use top feed to main breakers whether either top or bottom MCC cable entry is specified.
 2. The MCC will be fed from one 480V source, unless otherwise stated. Provide the necessary space for adequate bending radius and spreading room to properly train and terminate the cables specified on the Drawings. Where large (350 MCM and above) or parallel cables are used as feeders, provide a separate termination compartment alongside the main breaker for cable entry.
 3. Provide a separate compartment with a hinged front access door and suitable space for terminations for incoming cables. Provide compression type lugs in the quantity shown on the diagram. Allow space for a cable bending radius not less than ten times the diameter of the cable. The cable size is shown on the one-line diagram. Install current transformers and phase monitor coils in this compartment on fixed horizontal mounting brackets. Do not loosely place coils around feeder cables.
 4. Furnish surge protection devices as specified in Section 16290 - Primary Instrumentation Devices, located downstream from the main breaker or lugs. Mount surge arresters in an isolated, completely enclosed cubicle.
 5. When shown on the one-line diagram, install a voltmeter and an ampere-meter with switches in the incoming feed section. Provide meters of the switchboard type with one percent accuracy, 4-1/2 inch diameter face with a minimum of 240 degree direct reading scale. A single electronic meter may be used in lieu of electro-mechanical meters.

MOTOR CONTROL CENTER

K. Combination Starter Unit

1. Provide a standard combination motor starter unit which consists of a motor circuit protector (MCP), a magnetic motor starter, and an overload relay. Install starter and circuit protective device and control power transformer in a plug-in unit. The ratings of the components are shown on the one-line diagram.
2. Provide motor starters conforming to NEMA standards for the horsepower of the motors with which they are to be used and which are suitable for full voltage, across-the-line starting. Select starters with pickup and dropout voltages of not greater than 85 percent and 60 percent of rated voltage, respectively. Do not use a starter smaller than NEMA Size 1.
3. For NEMA size 4 and larger, provide vacuum-type contactors.
4. Select overload relays designed so that any attempt for reset immediately after operation cannot result in damage to the unit. Provide running protection for the motor and all other series components, based upon the tripping characteristics of the overload relay.
5. Utilize motor management relays of the solid state type with adjustable overload, phase unbalance and phase failure sensitivity. Refer to specification 16662.
6. Starters shall have a minimum of one NC and one NO auxiliary contacts in addition to the seal-in contact.
7. Have reversing contactors and 2-speed starters both mechanically and electrically interlocked to prevent both contactors from being engaged at one time.
8. Provide an MCP of the magnetic type with a fault interrupting capability suitable for the complete starter unit.
9. Provide each combination starter unit with its own control power transformer with Class B insulation and 120 volt secondary.
10. Place fuses on the secondary side of control power transformers with one dual element fuse. Have control transformers separately fused on the primary side with two dual element fuses.
11. Unless otherwise called for on the one-line diagram, the minimum rating of the control power transformer shall have the capacity to operate all connected loads including motor space

heaters. The minimum for the various sizes of starters, shall be as follows:

NEMA Size 1	150 VA
NEMA Size 2	150 VA
NEMA Size 3	250 VA
NEMA Size 4	500 VA

12. Connect the control power transformer so that it is de-energized when the circuit breaker is opened.

L. Reduced Voltage Starters

1. If reduced voltage starters are specified, provide the closed transition auto-transformer type.
2. Construct each reduced voltage auto-transformer starter unit with a molded-case circuit breaker in combination with a closed transition type auto-transformer starter with 50 percent, 65 percent, and 80 percent taps. Set the starter on the 65 percent tap. The starter shall have three phase overload relays and shall be ambient temperature compensated with manual reset. Include a thermal switch wired to protect the auto-transformer from overheating. Control timing of the starting period by an adjustable accelerating relay.
3. Provide heavy duty, NEMA type, autotransformers sized for a minimum of 125 percent of the motor load.

M. Terminal Blocks

1. Provide terminal blocks conforming to NEMA/ANSI ICS 4 type rated 600 volts, with screw type terminals to accommodate non-insulated ring tongue wire lugs for No. 18 through No. 10 size wire for field connection.
2. Use a sufficient number of terminal blocks so circuits for 480-volt and 120-volt service can be wired to a separate group of terminal blocks, making power and control circuit readily identified for safety during maintenance.
3. Wire all auxiliary contacts to terminal blocks.

N. Units

MOTOR CONTROL CENTER

1. Equip each unit compartment with barriers to isolate it from adjacent devices in the control center and prevent communication of faults from one compartment to another.
2. All full voltage starter units through NEMA Size 5 and all feeder breakers through 400 Amp shall be of the draw-out push in/ pull out type. Draw-out provisions shall include a positive guide rail system and stab shrouds to absolutely ensure alignment of stabs with the vertical bus. Draw-out units shall have a tin-plated stab assembly for connection to the vertical bus. No wiring to these stabs shall extend outside of the draw-out unit.
3. Install an individual front door on each unit compartment. Make each door interlocking with the circuit disconnect so that the door may not be opened while the circuit disconnect is in a closed position. Provide a means for overriding this interlock.
4. Use padlocking arrangements that permit locking circuit disconnect in the open position with a minimum of three padlocks when the door is closed.
5. Arrange components so that removal of a starter or breaker unit does not require removal of its door, or the removal of an adjacent unit.
6. Place unit wiring diagrams in the print pocket on the inside of each unit door.
7. Furnish units designated as future or spare complete with guide rails, separator bars, doors, and operating hardware required to permit completion of the unit by the addition of a combination starter or feeder breaker unit.
8. For any unused space that is not suitable for the addition of a plug-in unit, fabricate and install a plain bolted sheet metal cover.
9. Identify electrical components, such as relays, breakers, terminal strips, and starters, with laminated nameplates as required in Section 16195.

O. Buses and Connections

1. Extend the main horizontal copper bus across the assembly to form a complete continuous bus. Support it in at least two places in each vertical section using glass-reinforced, polyester-type insulators which are impervious to moisture and adverse atmospheric conditions.

2. Fabricate buses from tin plated copper bars. Use buses designed to operate at individual rate full load current without exceeding a 50 degrees C temperature rise at 40 degrees C ambient temperature as defined in ANSI/UL 845. The continuous current rating of the main and branch buses shall be as stated on the one-line diagram.
3. Bolt connections to main and branch buses. Make joints and contact surfaces free of burrs and irregularities.
4. Provide tin-plated, compression-type cable connectors (NEMA 2-hole) for each bus bar in the main feed cubicle. Select connectors of adequate size and quantity for the feeder cables.
5. Make provision for extension in both directions for future sections.
6. Install both main and branch buses so they are phased in the order A-B-C from front-to-rear, top-to-bottom, and left-to-right as viewed from the front of the MCC.
7. Have a copper ground bus extend the full length of the MCC near the bottom, with provision for extension into future sections. It shall be amp rated at a minimum of 25 percent of horizontal power bus. Provide compression lugs on each end of the ground bus for connection of the grounding copper conductor. Permanently ground the non-current carrying metal parts of equipment within each MCC through the ground bus in accordance with ANSI/UL 467. Terminate ground cables to the ground bus by means of the connectors.
8. The vertical bus shall be completely isolated and insulated by means of a labyrinth design barrier. It shall effectively isolate the vertical buses to prevent any fault-generated gases to pass from one phase to another. The vertical bus shall include a shutter mechanism that will allow the unit stabs to engage the vertical bus every 6 inches and provide complete isolation of the vertical bus when a unit is removed. Provide one shutter mechanism for all future spaces and covers for the balance of openings.

P. Wireways

1. Provide each section with horizontal wiring space at both the top and bottom. Make wiring spaces line up with adjacent sections to form a continuous wireway for the entire length of the MCC.

MOTOR CONTROL CENTER

2. In addition, provide each section with a wireway space at least 4 inches wide between the units and side unit wiring. Secure the wireway with a tight fitting hinged access door of formed sheet metal. Furnish wire straps in the vertical wireway to group individual conductors. Tie wires securely in place for a neat, orderly installation.
3. Completely enclose both horizontal and vertical wireways and isolate them from exposure to any live parts.
4. Use control wiring that is a minimum No. 14-AWG copper, 600 volts, tin plated, Type TA, TBS or SIS as defined in ANSI C37.30.6.
5. For current transformer wiring, use No. 10 AWG copper which is otherwise, the same as control wiring.
6. Power and control cables may enter the MCC only at bottom. Provide suitable opening in bottom of MCC for cable entry. Collect power and control cables neatly in separate bundles.
7. Make wires continuous between terminals and other connections, without splices.
8. Identify wiring at both ends with same number, machine printed on heat shrink type sleeves as specified in Section 16195 - Electrical Identification.

Q. Control Devices

1. Provide heavy duty oil tight pushbuttons, selector switches and indicating lights as specified on drawings.
2. Provide indicating lights which are push-to-test LED type with transformer and 100,000 hour lamp life.

R. Space Heaters: Install thermostat controlled electric space heaters to prevent condensation of moisture in the control centers. The rated voltage of these heaters shall be double the voltage applied. Make thermostats adjustable, and set to cut out when the temperature rises to an ambient of 30 degrees C (240 volt rated space heaters operated on 120 volt which power is derived from a local panelboard).

S. Nameplates

1. Use engraved phenolic with black lettering and white background for nameplates on individual units as well as the main nameplate for the assembly.

2. Make MCC compartment nameplates 1" x 3" with approximately 1/4 inch high lettering. Make MCC main nameplates 8" x 2" with 1 inch high lettering. Secure nameplates with self-tapping stainless steel metal screws.
3. Provide a blank nameplate for spare compartments.
4. Word nameplate captions as indicated on the one-line diagram.
5. Label all components in the MCC with phenolic nameplates as required in Section 16195.

T. Markings – Hazard Warnings

1. Manufacturer shall provide Manufacturer's Markings as specified in NEC 110.16.
2. Manufacturer shall provide Field-Applied Hazard Markings according to NEC 110.21(B).

U. Finish

1. Thoroughly clean the inside and outside of the MCC of foreign matter, excessive oxide, scale, weld spatter, and flux. Repair fabricating scars and rough edges by welding and grinding before painting, followed by heat treatment, if required by the governing code or standard.
2. Give a finish coat of manufacturer's standard enamel for compartment doors, cover plates, and structural parts of the MCC. Do not apply paint or filler until repairs, tests, and final shop inspection are completed. Epoxy based powder coat is acceptable.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify dimension of the housekeeping pad and the embedded leveling channels and conduit stub-ups.

3.02 INSTALLATION

- A. Install the motor control center in accordance with the manufacturer's published instructions.

MOTOR CONTROL CENTER

- B. Torque bus bar bolts to manufacturer's recommendations and tighten nuts and bolts on the steel structure to ensure structural integrity.
- C. Adjust the magnetic setting on motor circuit protectors in accordance with motor inrush currents (nameplate data).
- D. Select and install motor starter overload relay heater coils based on motor nameplate data.
- E. Touch up scratches and verify data on nameplates.
- F. Install warning labels on Motor Control Centers as required in Section 16195, 2.02, F.

END OF SECTION

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Section 16510

LIGHTING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specification for:

1. LED lighting fixtures
2. High intensity discharge (HID) lighting fixtures
3. Emergency lighting fixtures
4. Exit fixtures
5. Incandescent lighting fixtures
6. Photo cells

1.02 REFERENCES

A. American National Standards Institute/National Fire Protection Association (ANSI/NFPA)

1. No. 70 - National Electrical Code (NEC)
 - a. Article 410 - Lighting Fixtures, Lampholders, Lamps and Receptacles
 - b. Article 500 - Hazardous (classified) locations
 - c. Article 700 - Emergency Systems

2. No. 101 - Life Safety Code

B. American National Standards Institute (ANSI)

1. C78.379 - Electric Lamps - Incandescent and High Intensity discharge Reflector Lamps - Classification of Beam Patterns.
2. C82.4 - Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).

LIGHTING FIXTURES

- A. American National Standards Institute/Illuminating Engineering Society (ANSI/IES): The IES Handbook shall be used as a basis for design and construction of lighting systems.
- B. American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc./Illuminating Engineering Society (ASHRAE/IES): ASHRAE/IES 90.1 - 1989 - Energy Efficient Design of new Buildings Except Low-Rise Residential Buildings.
- C. American National Standards Institute/Underwriters Laboratories (ANSI/UL).
 - 1. UL8750 - LED Lighting Fixtures.
 - 2. UL1571 - Incandescent Lighting Fixtures.
 - 3. UL1572 - High Intensity Discharge Lighting Fixtures.
 - 4. UL844 - Fixtures for Hazardous Areas.

1.03 SUBMITTALS

- A. Submit the following under the provisions of Section 01330 – Submittal Procedures:
 - 1. Outline dimensions, support points and unit weight.
 - 2. Operation and maintenance data.
 - 3. Complete test report with photometric curves.
 - 4. Storage, handling, and installation recommendation.
 - 5. Connection diagrams.
 - 6. Catalog data.

1.04 QUALITY ASSURANCE

- A. Tests. Run manufacturer's tests on lighting fixtures in accordance with applicable Underwriters Laboratories (U.L.) Standards 1570, 1571 and 8750

1.05 DELIVERY, STORAGE AND HANDLING

- A. Have lighting fixtures individually packed to permit ease of handling and to provide protection from damage during shipping, handling and storage.

PART 2 P R O D U C T S

2.01 ACCEPTABLE MANUFACTURERS

- A. Benjamin Div., Thomas Industries
- B. Crouse-Hinds, Div. of Cooper Industries
- C. G.E. Lighting System
- D. Guth Lighting
- E. Holophane Company, Inc.
- F. Hubbell Lighting, Inc.
- G. Killark Electric Mfg. Company
- H. Lithonia Lighting
- I. Pauluhn Electric
- J. Wide-Lite Corporation
- K. Dual-Lite Company

2.02 REQUIREMENTS

- A. Provide lighting fixtures in accordance with the lighting plan Drawings and Lighting Fixture Schedules.

PART 3 E X E C U T I O N

3.01 INSTALLATION

- A. Install fixtures in accordance with manufacturer's instructions, NEC Articles 410, 500 and 700 as applicable, and the Drawings.
- B. Wire up fixtures in accordance with the Drawings and ensure proper switching, circuiting and balanced loads.
- C. Make sure proper grounding and bonding are provided for fixtures and raceways.
- D. Install specified lamps in each fixture.
- E. When applicable, aim and adjust fixtures in accordance with directions as indicated on the Drawings.

LIGHTING FIXTURES

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- F. Energize and test fixtures for proper operation.
- G. Check the illumination level with a light meter and ensure that sufficient light is reaching areas where tasks are performed and that egress paths are properly illuminated during emergency situations.

END OF SECTION

SECTION 16662

MOTOR MANAGEMENT RELAY

PART 1 GENERAL

1.01 CONDITIONS

- A. This specification is issued for this specific project only. Reproduction of this document for any other purpose is prohibited.
- B. Contractor shall comply with Section 3.07, A, 3 of this specification before bidding.

1.02 SUMMARY

- A. Section Includes:
 - 1. Motor Management Relay (MMR) and related devices commonly used with them.
 - 2. Programming Requirements.

1.03 REFERENCES

- A. National Fire Protection Association (NFPA): NFPA 70-90 - National Electrical Code (NEC).

1.04 DEFINITIONS

- A. Motor Management Relay (MMR): Primary protective function shall be the thermal model consisting of four key elements:
 - 1. Overload curves
 - 2. Negative sequence unbalance/single phase bias
 - 3. RTD Biasing (hot/cold motor compensation)
 - 4. Motor cooling time constants.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Motor Management Relay showing dimensions and features including installation details.

MOTOR MANAGEMENT RELAY

2. Current and potential transformers showing dimensions and features including installation details.

B. Product Data:

1. Product data for motor management relay, C.T.'s, P.T.'s and accessories specified in this Section, including descriptive data and C.T. ratios.
2. Include parts list.

C. Test Results: Certified reports of field tests and observations.

D. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exception" adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.06 QUALITY ASSURANCE

A. Items provided under this section shall be listed and labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

B. Regulatory Requirements:

1. Components and Installation:
 - a. NFPA 70 "National Electrical Code (NEC)."
 - b. Local codes and ordinances.

C. Single-Source Responsibility: Not Applicable.

1.07 MAINTENANCE

A. Extra Materials:

1. Maintenance Stock, Spare Parts: As recommended by Manufacturer.

PART 2 PRODUCTS

2.01 MOTOR MANAGEMENT RELAY (MMR)

- A. General: Provide MMR in indicated type, as integral components of panelboards, switchboards, and motor control centers; and also as individually enclosed and mounted single units. Provide externally mounted 48 hour UPS for MMR 120 volt source.
- B. Enclosures: Manufacturers draw-out construction to facilitate testing and maintenance.
- C. Features: The motor management relay shall include complete power metering. An events recorder shall store the last 40 events. Sixteen cycles of waveform data shall be stored each time a trip occurs. A simulation feature shall be available for testing the relay. The user interfaces shall include:
 - 1. A 40 character illuminated vacuum fluorescent display and associated keypad to provide access to actual values and set points.
 - 2. A front RS232 serial port for set point programming.
 - 3. An RS485 serial port which shall use an open protocol with baud rates selectable up to 19,200 bps.
 - 4. An independent auxiliary RS485 port shall be available for added security or for use by maintenance personnel.
 - 5. Interface software shall be provided in a Windows format.
- D. The stator protective thermal model shall combine inputs from positive and negative sequence currents and RTD winding feedback. The protection shall also include:
 - 1. Stall
 - 2. Jam
 - 3. 12 RTD inputs
 - 4. Ground Overcurrent
 - 5. Short Circuit
 - 6. Differential protection using CT inputs; (6) from both sides of the machine winding.

MOTOR MANAGEMENT RELAY

7. Voltage transformer inputs which shall be used to provide over-voltage, under-voltage, voltage phase reversal, over-frequency and under-frequency functions.
8. MMR shall store up to 40 time and date stamped events, including the pre-tip data. For each trip, the MMR shall store a trace of 8 cycles pre-trip and 8 cycles post-trip for all measured AC quantities.

E. Manufacturer: G.E. Multilin

F. Model: SR 469-P5-HI-A20 with door mounted draw-out case.

2.02 CURRENT TRANSFORMER (CT)

- A. Phase current CT's shall be provided for all three phase legs. In addition, a ground CT shall be provided. CT size and rating to be determined by MMR manufacturer and shall be furnished as part of the MMR equipment package. Include mounting brackets and all appurtenances.

2.03 POTENTIAL TRANSFORMER (PT)

- A. A three phase PT shall be provided for voltage measurements of all three phase legs. Provide Flex-Core Part No. 2VT 460-480 FF, size and rating shall be determined by MMR manufacturer and shall be provided as part of the MMR equipment package. Include mounting bracket and all appurtenances.

2.04 SOFTWARE

- A. Manufacturers programming, operation, maintenance and data analysis software shall be included in MMR equipment package. Complete instructions and any special equipment required for installation, setup, programming, operation, maintenance and data analysis shall be provided as part of the MMR equipment package. Special cables, plugs and adaptors for loading and downloading data to a computer shall be included.
- B. All programming and startup shall be done by Double E Engineering.
- C. All programming will be coordinated with Motor Manufacturers and shall conform to their standards.

2.05 UNINTERRUPTIBLE POWER SUPPLY – (NOT APPLICABLE)

PART 3 EXECUTION

3.01 INSTALLATION

A. MMR

1. Install MMR as shown on plans or as described in specifications.
2. Installation shall be done according to manufacturers recommendations and shall be done in a neat and professional manner.
3. Locate as indicated and install in accordance with manufacturer's written installation instructions.
4. Provide devices and connections to MMR as shown on plans.

- B. Current and Potential Transformers: CT's and PT's shall be rated for electrical system voltage and current parameters and shall be installed according to the manufacturer's recommendations with hardware intended for mounting PT's and CT's.

3.02 IDENTIFICATION

- A. Identify components and wiring in accordance with Section 16195 – "Electrical Identification".

3.03 CONTROL WIRING INSTALLATION

- A. Wiring to CT's shall be installed according to related NEMA and NEC standards and codes. All wiring to be rated for application and shall be neatly bundled and secured with clamps. All wires are to be terminated with proper lugs. C.T. lugs shall be ring type only.

3.04 CONNECTIONS

- A. Check connectors, terminals, bus joints, and mountings for tightness.
- B. Tighten field-connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

3.05 GROUNDING

- A. Provide equipment grounding connections for individually mounted Overcurrent Protective Devices (OCPD) units as indicated and as required by

MOTOR MANAGEMENT RELAY

NEC. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

3.06 COORDINATION STUDY

- A. Where coordination study recommends changes in types, classes, features or ratings of equipment or devices indicated, make written request for instructions. Obtain instructions from Engineer before ordering equipment or devices recommended to be changed.

3.07 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Supplier's or manufacturer's technician for equipment specified herein shall be present at job site or classroom designated by Owner for minimum of 1 workday, travel time excluded, for assistance during plant construction, plant startup, equipment adjustment, and training of Owner's personnel for plant operation. Include minimum of:
 - a. One manday for Instructional Services.
2. Supplier or manufacturer shall direct services to specific system and equipment operation, maintenance, and troubleshooting.
3. Programming of the motor management relay alarm and trip set points and all testing shall be performed by Double E Engineering. No Exceptions.
4. All of the motor data available from the manufacturer, including overload curves and thermal characteristics, and all motor circuit information must be furnished by the Contractor to the Engineer a minimum of two weeks prior to programming of Multilin unit.

B. Testing:

1. Reports: Prepare certified written reports on tests and observations. Report defective materials and workmanship and unsatisfactory test results. Include complete records of repairs and adjustments made.
2. Labeling: Upon satisfactory completion of tests and related effort, apply label to tested components indicating test results, date, and responsible person.
3. Schedule visual and mechanical inspections and electrical tests with at

least 1 week's advance notification.

4. Pre-testing: Upon completing installation of system, perform following preparations for tests:
 - a. Make insulation resistance tests of OCPD buses, components, and connecting supply, feeder, and control circuits.
 - b. Make continuity tests of circuits.
 - c. Include full updating on final system configuration and parameters where they supplement or differ from those indicated in original Contract Documents.
 - d. Comply with manufacturer's instructions for installation and testing of OCPDs.
5. Visual and mechanical inspection: Include following inspections and related work.
 - a. Overcurrent-Protective-Device Ratings and Settings: Verify indicated ratings and settings to be appropriate for final system arrangement and parameters. Where discrepancies are found, test organization shall recommend final protective device ratings and settings. Use accepted revised ratings or settings to make final system adjustments.
6. Retest: Correct deficiencies identified by tests and observations and retest. Verify by system tests that specified requirements are met.

3.08 CLEANING

- A. Upon completion of installation, inspect MMR. Remove paint splatter sand other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

4.01 MOTOR PROTECTION RELAY (MPR) / REMOTE DISPLAY

- A. General: Provide MPR in indicated type, as integral components of motor control centers; and also as individually enclosed and mounted single units.
- B. Designed to monitor and protect any 3-phase, 200-480VAC motor drawing 1-800 full load amps (external CTs are required for motor current draw above 9 FLA).
- C. A 3-digit LED display that is used for programming, real-time operational

MOTOR MANAGEMENT RELAY

information and displaying diagnostic codes and aid in troubleshooting a fault condition.

D. Features protection 3-phase motors from:

1. Voltage single-phase/phase loss
2. Phase reversal
3. Low voltage
4. High voltage
5. Voltage unbalance
6. Rapid cycling
7. Undercurrent
8. Overcurrent
9. Current unbalance
10. Current single-phase/phase loss
11. Low control voltage
12. Ground fault
13. Contact failure
14. Low power
15. High power

E. Communication Capabilities:

1. Modbus RTU
2. Modbus TCP
3. DeviceNet
4. Profibus

- F. The Equipment interface shall have the capability of connecting to the following systems:
 - 1. HMI (Human-Machine Interface)
 - 2. SCADA (supervisory Control and Data Acquisition)
 - 3. DCS (Distributed Control System)
 - 4. PLC (Programmable Logic Controllers)
 - 5. SymCom Model RM-1000 Modbus remote display
 - G. Manufacturer: SymCom
 - H. Model: 777-LR-P2 Surface or DIN rail mount
 - I. Model: RM-1000
- 4.02 CURRENT TRANSFORMER (CT)
- A. Motor 9 amp and above, phase current CT's shall be provided for all three phase legs. CT rating shall be determined based on the size of manufacturer's motor FLA.
- 4.03 INSTALLATION
- A. MPR / REMOTE DISPLAY
 - 1. Install MPR as shown on plans or as described in specifications.
 - 2. Installation shall be done according to manufacturer's recommendations.
 - 3. Locate as indicated and install in accordance with manufacturer's written installation instructions.
 - 4. Provide devices and connections to MPR as shown on plans.
 - 5. Provide remote display and connect to MPR via RS485
 - B. Current Transformer: CT's shall be rated for current parameters and shall be installed according to the manufacturer's recommendations with hardware intended for mounting CT's.

END OF SECTION

Section 16670

LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Lightning protection system, including design, installation and materials.

1.02 REFERENCES

- A. American National Standards Institute/National Fire Protection Association (ANSI/NFPA)
 - 1. NFPA No: 780 - Lightning Protection Code
 - 2. NFPA No: 70 - National Electrical Code
 - a. Section 250-46 - Spacing from Lightning Rods
 - b. Section 250-86 - Use of Lightning Rods
- B. American National Standards Institute/Underwriters Laboratories (ANSI/UL)
 - 1. UL 96 - Lightning Protection Components
 - 2. UL 96A - Safety Installation Requirements for Lightning Protection System
 - 3. Lightning Protection Institute (LPI) - LPI 175 - Installation Standards

1.03 SUBMITTALS

- A. The following Section 01330 - Submittal Procedures.
 - 1. Outline dimensions and weights
 - 2. Installation and maintenance manual
 - 3. Catalog data
 - 4. Complete design and construction drawings
 - 5. Underwriters Laboratories, Inc. Master Label Certification

LIGHTNING PROTECTION SYSTEM

6. Lightning protection institute certified system certification.

1.04 QUALITY ASSURANCE

- A. See Part 3.02 – INSTALLATION

1.05 PREPARATION FOR SHIPPING

- A. Pack and crate materials to permit ease of handling and provide protection from damage during shipping, handling and storage.

PART 2 P R O D U C T S

2.01 ACCEPTABLE MANUFACTURERS

- A. Advanced Lightning Technology
- B. East Coast Lightning Equipment
- C. Harger Lightning Protection
- D. Thompson Lightning Protection

2.02 DESIGN, CONSTRUCTION AND MATERIALS

- A. System Design: Provide a functional and unobtrusive lightning protection system to include complete design drawings, for each structure and the site showing the type, size, and locations of all grounding, down conductors, through roof/through wall assemblies, roof conductors and air terminals, shall be submitted to the Engineer for approval. Departures from the Drawings or submittals shall be submitted to the City Engineer for approval.
- B. Lightning Protection Equipment: Materials shall be copper and bronze and of the size, weight, and construction to suit the application and used in accordance with PLI, UL, and NFPA code requirements. Use bolt type connectors and splicers Class I and Class II structures. Pressure squeeze clamps are not acceptable. Use stainless steel mounting hardware to prevent corrosion.
- C. Aluminum Components: Aluminum materials may not be used except on roofs that utilize aluminum roofing components. On aluminum roofs or where aluminum parapet caps are used, utilize aluminum components for roof lightning protection equipment to ensure compatibility. However, use copper down leads and grounding with the bimetal transition occurring at the through roof assembly with an approved bimetal through roof assembly.

LIGHTNING PROTECTION SYSTEM

purpose. Structural steel may be utilized in the installation as outlined by UL, NFPA, and LPI.

- D. Upon completion of the installation, the lightning protection installer shall secure and deliver to the Contractor for submittal to the City Engineer, the Underwriters Laboratories, Inc., Master Label certification and the Lightning Protection Institute Certified System certification. The system will not be accepted without the UL Master Label plate and the LPI certification certificate.

END OF SECTION

Section 17100

PRESTRESSED CONCRETE CAMERA POLE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This specification is to establish design and quality standards for static cast concrete poles for WiMAX antenna support and CCTV camera.

1.02 QUALITY ASSURANCE

- A. The concrete poles furnished under these specifications shall be designed and manufactured in accordance with requirements and/or recommendations of the American Concrete Institute Standard "Building Code Requirements for Structural Concrete" (ACI 318 - Latest Edition), unless otherwise specified.

- B. Poles shall be designed in accordance with the Prestressed Concrete Institute "Guide for Design of Prestressed Concrete Poles."

- C. All pole design and structural calculations shall be prepared by a licensed professional engineer experienced in prestressed concrete design. Calculations shall be signed and sealed by a licensed professional engineer, licensed in the State of Texas.

- 1. Manufacturer must have a minimum of 10 years experience manufacturing static cast, square tapered prestressed concrete poles. Documentation of such experience shall be provided in the submittal.
- 2. Manufacturer shall be certified by the City of Houston as an Approved Fabricator of Precast Concrete. A copy of the current certification documentation shall be provided in the submittal.
- 3. No alternate pole designs to the pre-engineered, static-cast, prestressed concrete pole will be allowed unless pre-approved by the owner TEN (10) days prior to the bid date.

1.03 ACCEPTABLE MANUFACTURERS

- A. Lonestar Prestress Mfg., Inc. Cat. No. 462602-CP-L
- B. Or Approved Equal

PRESTRESSED CONCRETE CAMERA POLE

PART 2 PRODUCTS

2.01 PHYSICAL CHARACTERISTICS

- A. All poles shall be prestressed concrete and suitable for direct embedment into the ground without special foundations.
- B. Shape and Length: Poles shall be square in cross-section, with chamfered corners, and shall have a standard taper of 0.162 inch per foot. Cross-sectional dimensions shall not deviate by more than 3/8 inch. The allowable tolerance for overall length shall be +3 inches and -2 inches. The width of the bottom face of the pole (as it is cast) may be less than the top face.
- C. Finish: The pole shall have a smooth gray finish with no cracks. The top surface of each pole shall be troweled until all projections, depressions, and irregularities have been removed and the entire surface has a smooth texture and neat lines. Square corners and sharp edges shall be tooled to form smooth, chamfered corners. All small cavities shall be cleaned, saturated with water and then filled with mortar. A small cavity is defined as one larger than 1/4 inch but smaller than 3/4 inch in diameter, and less than 3/8 inch deep. Larger non-structural cavities and spalls shall be repaired by opening the side of the damaged area on a 1 to 1 slope using a mechanical grinder, cleaning thoroughly and filling with a high-strength non-shrink concrete repair material. Poles with other defects may be repaired only upon authorization of, and using the method prescribed by the Design Engineer.
- D. Sealing Steel Strands: The end of each reinforcing strand (in the tip and butt) shall be burned back to a minimum depth of 1/2 inch. The holes left by the removal of the strand shall be thoroughly cleaned of any loose residue. The holes shall then be completely filled with non-shrink grout and smoothed evenly with tip or butt surface.
- E. Cover: The prestressing strands shall have a minimum concrete cover of 1.5 inch. The centerline axis along the faces of the poles shall be clear of embedded steel except for stirrups, spiral reinforcement and fabrication devices, so that 3/4 inch diameter holes may be drilled without interference from the strands.
- F. Sweep: Sweep is the deviation of a pole from straightness. A straight line joining the edge of the pole at the butt and the edge of the pole at the top shall not be distant from the surface of the pole at any point by more than 3/8 inch for each 10 feet of length.
- G. Hole Drilling: Poles shall be drilled in accordance with approved drawings. The location of holes shall not deviate by more than 3/8 inch. Holes drilled after removal from molds shall be drilled from both sides of the pole and shall be uniform in entrance and exit. Holes drilled from opposing sides of the pole must be in the same plane and be centered on both faces.

PRESTRESSED CONCRETE CAMERA POLE

- B. Poles of each standard type, unless otherwise specified, shall be designed for the ultimate groundline moments from the above noted wind pressures with the modifications to accommodate allowances for handling, transportation and erection.
- C. Poles shall be capable of withstanding single point pickup from the horizontal position when lifting from a point 30% of the overall length down from the tip.

2.04 GROUNDING

- A. Poles shall include a concrete encased electrode conforming to NEC 250.52 (A) (3).
- B. Poles for both WiMAX antenna and CCTV cameras shall have separate handholes for camera and signal cabling and WiMAX antenna.

PART 3 EXECUTION

3.01 QUALITY CONTROL

- A. Tests shall be made and records shall be maintained in accordance with the requirements of Prestressed Concrete Institute MNL-116, "Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products."

3.02 DRAWING AND DESIGN INFORMATION

- A. Manufacturer shall furnish detailed design drawings for the poles bid or supplied, including but not limited to the following:
 - 1. Total weight.
 - 2. Dunnage and pickup points, including both one-point and two-point pickup locations.

3.03 INSTALLATION

- A. Poles shall be supported and protected during site storage, lifting and setting to prevent damage to the pole. Spalls or other damage incurred during these operations shall be repaired to restore the pole to "as new" condition.

END OF SECTION

Section 17200

PERPETUAL POWER UNIT (PPU) AND WiMAX RADIO

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This specification is to establish design and quality standards for Perpetual Power Unit (PPU) and WiMAX radio.

1.02 ACCEPTABLE MANUFACTURERS

- A. Clear Site Communications, Inc., Model No. PPU-1.
- B. Or Approved Equal.

PART 2 PERPETUAL POWER UNIT (PPU)

2.01 PHYSICAL CHARACTERISTICS

- A. The Perpetual Power Unit (PPU) provides a clean uninterrupted flow of power to outdoor devices that require 24/7 operation as used for video monitoring, communications and remote sensing, even if the power source is undependable or intermittent. When power is available, the PPU will supply power to the loads (application devices) as well as charge and maintain its own deep cycle battery bank. When the power input is cut, no down time results since the application devices continue to receive power from the battery bank.
- B. The PPU provides functions that a UPS provides, but on a much larger scale. Depending on the load and configuration, the PPU can power application devices for days without any power input, then very rapidly recharge its own battery bank when power is provided.
- C. The PPU makes available real time information about its power input, load, and charging system via its Ethernet interface. Warning can be automatically sent by mail or text if input power is unexpectedly absent. This allows power problem to be detected and responded to with no system down time. Also, in IP communications networks, the PPU can monitor the application devices and automatically reset them if a problem is detected.

2.02 SPECIFICATIONS

- A. Input Voltage Range: 100-277VAC 50/60Hz

**PERPETUAL POWER UNIT (PPU)
AND WIMAX RADIO**

*11th Street Facility Odor Control
WBS No.: R-000020-0010-3*

- B. Max Power Consumption: 225Watts
- C. Output Voltage Range: 11-16VD
- D. Max Load: 100 Watts
- E. Batter Type: VRLA Sealed AGM Deep Cycle 12V
- F. Battery Capacity: 104Ah
- G. Max Charging Power: 180 Watts (15 Amps)
- H. Temperature Compensated: Yes
- I. Low Voltage Load Disconnect: Yes
- J. Electronic Protections: Overload, Short Circuit, High Voltage
- K. System Controller (PPC): Web Based, Remote Control Remote Alerts, connector RJ45
- L. Breakers: Battery, DC In, PPC, Load.
- M. Enclosure: Vented Aluminum Nema 3R, Dimensions 16"x16"x10"
- N. Operating temperature: -26 to 45 degree Celsius
- O. Operating Humidity: 10% to 95% Non-Condensing.

PART 3 W I M A X R A D I O

3.01 ACCEPTABLE MANUFACTURER

- A. Telrad., Model No. CPE7000 Outdoor
- B. No substitution

3.02 SPECIFICATIONS

- A. IP67 environmental rating – suitable for the harshest outdoor deployment scenarios
- B. High gain 15dBi embedded antenna
- C. TD-LTE – 3GPP Release 9, UE Category 4
- D. Dual Mode WiMAX/LTE solution enabling transition from WiMAX to TD-LTE

- E. TD-LTE – 3GPP Release 9, UE Category 4
- F. One Data port, one VoIP port
- G. High gain 15dBi embedded Antenna
- H. Easy installation saves time and money
- I. Device Management – Web and TR69
- J. IP67 environmental rating – fully ruggedized - suitable for the harshest outdoor deployment scenarios.

END OF SECTION