

CONTRACT DOCUMENTS, TECHNICAL  
SPECIFICATIONS AND CONSTRUCTION DRAWINGS

WALLER COUNTY PRECINCT 4 ANNEX BUILDING WATER PLANT  
WEI PN 5996-20001

PREPARED FOR:  
WALLER COUNTY  
775 BUSINESS 290 EAST  
HEMPSTEAD, TEXAS 77445

PREPARED BY:

 **WATERENGINEERS, INC.**  
*Water & Wastewater Treatment Consultants*  
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WATERENGINEERS, INC.  
TBPE FIRM No. 2066



JANUARY 2020

# WALLER COUNTY PRECINCT 4 ANNEX BUILDING WATER PLANT

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## INVITATION TO BIDDERS

Sealed bids addressed to Waller County on behalf of Waller County Precinct 4 Annex Building Water Plant will be received at the office of WALLER COUNTY AUDITOR OFFICE, 836 Austin Street, Suite 221, Hempstead, Texas 77445 (Tel: 979-826-7740) until March 17, 2020, at 2:00 PM. The bids will be publicly opened on Wednesday, March 4, 2020 in Commissioner's Court and read for material, equipment, labor and supervision necessary or incidental to the Construction of the Waller County Precinct 4 Annex Building Water Plant. The project consists of constructing an 5-inch SDR 17 PVC dual string cased well capable of producing 48 gpm with a 5 HP submersible pump, the installation of a ground storage tank, hydropneumatic tank, booster pumps, disinfection equipment and operations building air conditioner/heat pump; along with the associated piping, valves, site work and electrical work. A pre-bid conference will be held at the project site located at 32225 US Highway 90 Business in Brookshire, Texas on Tuesday, February 18, 2020 at 2:00 PM (attendance is not mandatory). Plans, specifications and bid documents may be obtained from the Waller County website in electronic format. Performance and Payment Bonds will be required to be furnished at the time the Agreement is executed. The Owner reserves the right to reject any or all bids.

**SECTION 00200**

**INSTRUCTIONS TO BIDDERS**

**1. DEFINITIONS**

- A. Terms used in these Instructions to Bidders which are defined in the Construction Services Agreement have the meanings assigned to them in the Construction Services Agreement. Other terms used in the Bidding Documents and not defined elsewhere have the following meanings, which are applicable to both the singular and plural thereof:
1. Bidder: One who submits a bid directly to the Owner.
  2. Successful Bidder: The most qualified, responsible and responsive bidder to whom the Owner makes an award.
  3. Bidding Documents: The Invitation to Bidders, Instructions to Bidders, Special Conditions (Underground Utilities), Special Conditions to the Agreement, Proposal and the Proposed Contract Documents (including Addenda issued prior to receipt of Bids).

**2. PREPARATION OF BIDS**

- A. Complete sets of bidding documents must be used in preparing bids. Neither the Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of bidding documents. Copies of bidding documents are made available only for the purpose of obtaining bids on the work and do not confer a license or grant for any other use.

**3. EXAMINATION OF CONTRACT DOCUMENTS AND SITE**

- A. It is the responsibility of each Bidder before submitting a Bid to (a) examine the Contract Documents thoroughly, (b) visit the site to become familiar with local conditions that may affect cost, progress, performance, or furnishing of the Work, (c) consider federal, state and local Laws and Regulations that may affect cost, progress, performance or furnishing of the Work, (d) study and carefully correlate Bidder's observations with the Contract Documents, and (e) notify ENGINEER of all conflicts, errors, or discrepancies in the Contract Documents discovered by the Bidder.
- B. Information and data reflected in the Contract Documents with respect to Underground Facilities at or contiguous to the site is based upon information and data furnished to OWNER and ENGINEER by owners of such Underground Facilities or others, and OWNER does not assume responsibility for the accuracy or completeness thereof unless it is expressly provided otherwise in the Construction Services Agreement.

- C. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders on subsurface conditions, underground facilities, and other physical conditions, and possible changes in the Contract Documents due to differing conditions appear in Paragraph 28 of the Construction Services Agreement.
- D. Before submitting a Bid, each Bidder will, at Bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests, and studies, and obtain any additional information and data which pertain to the physical conditions (surface, subsurface, and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance, or furnishing of the Work, and which Bidder deems necessary to determine its Bid for performing and furnishing the Work in accordance with the time, price, and other terms and conditions of the Contract Documents.
- E. On request in advance, OWNER will provide each Bidder access to the site to conduct such explorations and tests as each Bidder deems necessary for submission of a Bid. Bidder shall clean up and restore the site to its former condition upon completion of such explorations.
- F. Failure to perform such investigations during the Bid period shall not relieve Bidder from responsibility for investigations, interpretations and proper use of available information in preparation of Bidder's proposal.
- G. The lands upon which the Work is to be performed, rights-of-way, and easements for access there to and other lands designated for use by CONTRACTOR in performing the Work are identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by CONTRACTOR. Easements for permanent structures or permanent changes in existing structures are to be obtained and paid for by OWNER unless otherwise provided in the Contract Documents.
- H. The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Contract Documents and such means, methods, techniques, sequences, or procedures of construction as may be indicated in or required by the Contract Documents, and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

#### **4. INTERPRETATION OF DOCUMENTS AND ADDENDA**

- A. All questions about the meaning or intent of the Contract Documents must be submitted to the Engineer in writing at least five (5) days prior to the opening of bids. Interpretations or clarifications considered necessary by ENGINEER in response to such questions will be issued by Addenda at least 48 hours prior to Bid Opening.

- B. Any interpretation of the Contract Documents will be made only by Addendum duly issued, and a copy of such addendum will be made available to each prospective bidder recorded by ENGINEER as having received a set of Contract Documents. Each Bidder is responsible for obtaining Addenda. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.
- C. Addenda may also be issued to modify the Contract Documents as deemed advisable by OWNER and ENGINEER.

**5. BID SECURITY**

- A. Bid Security is not required.

**6. CONTRACT TIME**

- A. The number of days within which, or the dates by which, the Work is to be substantially completed and also completed and ready for final payment (the Contract Time) are to be proposed by the Bidder.

**7. LIQUIDATED DAMAGES**

- A. Provisions for liquidated damages, if any, are set forth in the Agreement.

**8. SUBSTITUTE OR "OR EQUAL" ITEMS**

- A. The Contract, if awarded, will be on the basis of materials and equipment described in the DRAWINGS or specified in the Specifications without consideration of possible substitute or "or equal" items. Whenever it is indicated in the Drawings or specified in the Specifications that a substitute or "or equal" item of material or equipment may be furnished or used by CONTRACTOR if acceptable to ENGINEER, application for such acceptance will not be considered by ENGINEER until after the Effective Date of the Agreement. The procedure for submission of any such application by CONTRACTOR and consideration by ENGINEER is set forth in Section 01300 - Submittals.

**9. OWNER FURNISHED EQUIPMENT AND ELECTRICAL WORK**

Not Applicable

**10. BID FORMS**

- A. All Bids shall be completely filled out on the specified bid forms without modification or provisions unless otherwise required.
- B. The Bids shall be completed in duplicate. The original shall be filed with the OWNER and the Bidder shall keep the duplicate.

- C. The Bids must be clearly and legibly filled out in ink or typed. In case of ambiguity or lack of clearness in stating the prices tendered or the condition of the Bid, the OWNER reserves the right to consider the most favorable construction thereof or to reject the Bid from further consideration.
- D. All Bids must be officially executed. Bids by Corporations must be executed in the corporate name by the president or vice president (or other corporate officer, accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested by the secretary or assistant secretary. The corporate address and state of incorporation must be shown below the signature. Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature, and the official address of the partnership must be shown below the signature. All business entity names must be registered with the Secretary of State of Texas and appropriate office of registration.
- E. The Bid shall contain an acknowledgement of receipt of all Addenda (the numbers of which must be filled in on the Bid Form).

#### **11. SUBMISSION OF BIDS**

- A. Bids shall be submitted at the time and place indicated in the Notice to Bidders, and shall be enclosed in an opaque sealed envelope marked with the Project title, name and address of the Bidder. Bids will be securely kept unopened, until the specified time. The bids received after the specified time will not be considered. All incomplete Bids shall be considered non-responsive. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it.

#### **12. MODIFICATION AND WITHDRAWAL OF BIDS**

- A. Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered to the place where Bids are to be submitted at any time prior to opening of Bids.
- B. If, within 24 hours after Bids are opened, any Bidder files a duly signed, written notice with OWNER and promptly thereafter demonstrates to the reasonable satisfaction of OWNER that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid and the Bid security will be returned. Thereafter, that Bidder will be disqualified from further bidding on the Work to be provided under the Contract Documents.

#### **13. OPENING OF BIDS**

- A. Bids will be opened publicly.



**14. AWARD OF CONTRACT**

Contract will be awarded on basis of the best overall bid price **and** contract time.

- A. The Owner reserves the right to reject any and all bids, to waive any and all informalities not involving price, time or changes in the Work, to negotiate contract terms with the Successful Bidder, and to disregard all non-conforming, non-responsive, unbalanced or conditional Bids. Also, OWNER reserves the right to reject the Bid of any Bidder if OWNER believes that it would not be in the best interest of the Project to make an award to that Bidder, whether because the Bid is not responsive or the Bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by OWNER. Discrepancies in the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.
- B. In evaluating Bids, OWNER will consider the qualifications of the Bidders, whether or not the Bids comply with the prescribed requirements and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.
- C. OWNER may consider the qualifications and experience of Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work as to which the identity of Subcontractors, Suppliers, and other persons and organizations must be submitted as provided in the Construction Services Agreement. OWNER also may consider the operating costs, maintenance requirements, performance data, and guarantees of major items of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to the Notice of Award.
- D. OWNER may conduct such investigations as OWNER deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents to OWNER'S satisfaction within the prescribed time.
- E. If the Contract is to be awarded, OWNER will give the Successful Bidder a Notice of Award within 60 calendar days after the day of the Bid opening.

**15. CONTRACT SECURITY**

- A. Performance and payment Bonds are **NOT** required.

**16. INSURANCE CERTIFICATES**

- A. The CONTRACTOR shall provide and maintain a minimum coverage as defined in the Contract Documents. The companies providing the coverage shall be acceptable to the OWNER (Paragraph 12 of the Section 00500 Construction Services Agreement).

**17. SIGNING OF AGREEMENT**

- A. When OWNER gives a Notice of Award to the Successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement with all other written Contract Documents attached. Within 15 calendar days thereafter, CONTRACTOR shall sign and deliver the required number of counterparts of the Agreement, and attached documents to OWNER with the required Bonds. Within 10 calendar days thereafter, OWNER shall deliver one fully signed counterpart to CONTRACTOR. Each counterpart is to be accompanied by a complete set of the Drawings with appropriate identification.

**18. PRE-BID CONFERENCE**

- A. A pre-bid conference will be held at the time and place indicated in the Invitation to Bid (Section 00100). Representatives of OWNER and ENGINEER will be present to discuss the Project. **The Pre-Bid meeting is NOT mandatory.** ENGINEER will notify all prospective Bidders of record of any such Addenda as ENGINEER considers necessary in response to questions arising at the conference.

SECTION 00300

PROPOSAL FORM

**WALLER COUNTY PRECINCT 4 ANNEX BUILDING WATER PLANT**

To:     Waller County  
       Attn: Mr. Danny Rothe, Waller County Construction Manager  
       775 Business 290 East  
       Hempstead, Texas 77445

From: Bidder Company Name: \_\_\_\_\_

Re:     **WALLER COUNTY PRECINCT 4 ANNEX BUILDING WATER PLANT**

Having examined Bidding and Contract Documents prepared by WaterEngineers, Inc. and having examined site conditions, the undersigned proposes to furnish all labor, equipment and materials and perform all work for the completion of the above-named project. Owner will pay for the contracted improvements by making conventional progress and final payments during construction as set forth in Section 00500 – Construction Services Agreement. **THE FOLLOWING ITEMS ARE TO BE PROVIDED BY OTHERS; GROUND STORAGE TANK FOUNDATION, OPERATIONS BUILDING AND FOUNDATION, ALL WEATHER PAVING, CHAIN LINK FENCE, BOLLARDS, ELECTRICAL SERVICE TO OPERATIONS BUILDING, 60 AMP DISCONNECT AND WATER DISTRIBUTION LINE AFTER 90 DEGREE BEND.**

In submitting his Proposal, the undersigned agrees to the following:

- Proposer accepts the right of the Owner to reject any or all proposals, to waive formalities and to accept the proposal which Owner considers most advantageous, including best proposed contract time.
- Proposer will enter into and execute the contract, if awarded, for the Base Bid Proposal.
- Proposer will complete work in accordance with the Contract Documents within the proposed contract time.
- Proposer will mobilize to the project job site and begin work within 30 calendar days after receiving a written notice to proceed.

By signing, the undersigned affirms that, to the best of his knowledge, this Proposal has been arrived at independently and is submitted without collusion with anyone to obtain information or gain any favoritism that would in any way limit competition or give an unfair advantage over respondents in the award of this proposal.

**I.     WATER WELL BASE BID PROPOSAL AND ADD/DEDUCT BID AMOUNTS:**

Bidder offers to construct the complete Waller County Precinct 4 Annex Building 5-inch SDR 17 PVC cased dual-string water well, well pump and well pump control panel as required on the Drawings and in the Specifications. Bidder agrees to provide a temporary generator to conduct a 36-hour pump test and collect and submit all well testing samples to a TCEQ accredited laboratory, including chemical and radionuclide testing, and bacterial testing within 60 days as required on the Drawings and in the Specifications

for the total Base Bid amount of \_\_\_\_\_ (words)

\$ \_\_\_\_\_ (figures).



**V. ADDENDA**

Undersigned acknowledges receipt of Addenda Nos. \_\_\_\_\_

**VI. CHANGES IN THE WORK**

Undersigned understands that changes in the work shall be performed in accordance with the Construction Services Agreement.

**VII. LIQUIDATED DAMAGES**

It is understood that the CONTRACTOR shall substantially complete the work comprehended in this agreement, within the contract time proposed in Section III and agrees to accept a penalty of **\$500.00** a day for completion beyond that time.

**VIII. GENERAL**

The amounts proposed include all costs, commissions, overhead, permits and payments required and necessary for the complete work as specified. I/we acknowledge that we have read and understood the Contract Documents, Drawings and Technical Specifications and that the Proposal prices include all the work described therein. I/we acknowledge that if all proposal items are not fairly priced, the Owner may reject my/our Proposal.

If I/we are notified of the acceptance of this Proposal, I/we will:

- Furnish Certificates of Insurance verifying all insurance carried by the Contractor which shall apply to the project.
- Furnish a construction schedule satisfactory to the Owner within ten (10) days after the date of written notice to proceed is issued.

It is understood that the Owner reserves the right to reject any and all proposals. The undersigned certifies that the prices contained in this proposal have been carefully checked and are submitted as correct and final and furthermore that these prices will remain valid for a period of sixty (60) days after the scheduled proposal opening date.

By submitting a proposal, bidder agrees to waive any claim it has or may have against the Owner, the Engineer, and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any proposal; waiver of any requirements under the Proposal Documents; or the Contract Documents; acceptance or rejection of any proposals; and award of the Contract.

**BIDDER'S SIGNATURE**

\_\_\_\_\_  
Authorized Signature

\_\_\_\_\_  
Title

\_\_\_\_\_  
Name of Contracting Firm

\_\_\_\_\_  
Address

(Seal, if a Corporation)  
State whether Corporation,  
Partnership or Individual

\_\_\_\_\_  
Telephone

\_\_\_\_\_  
Date

END OF SECTION

SECTION 00611

PERFORMANCE BOND FORM

KNOW ALL MEN BY THESE PRESENTS: That \_\_\_\_\_ of the City of \_\_\_\_\_ of \_\_\_\_\_ county, and State of \_\_\_\_\_, as principal, and \_\_\_\_\_, authorized under the laws of the State of Texas to act as surety on Bonds for principals, are held and firmly bound unto Aqua Texas (Owner), in the penal sum of \_\_\_\_\_ for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, by these presents:

WHEREAS, the Principal has entered into a certain written contract with the Owner, dated the \_\_\_\_\_ day of \_\_\_\_\_, 2020 for the Construction of the Waller County Precinct 4 Annex Building Water Plant, which Contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH that if the said Principal shall faithfully perform said Contract and shall in all respects duly and faithfully observe and perform all and singular the covenants, conditions and agreements in and by said Contract agreed and covenanted by the Principal to be observed and performed, and according to the true intent and meaning of said Contract and Plans and Specifications hereto annexed, then this obligation shall be void; otherwise to remain in full force and effect;

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

Surety, for value received, stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract, or to the work performed thereunder, or the Plans, Specifications, or Drawings accompanying the same, shall in any way affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract, or to the Work to be performed thereunder.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

**Contractor**

**Surety**

\_\_\_\_\_

\_\_\_\_\_

By: \_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

Address: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

The name and address of the Resident Agent of Surety is:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

END OF SECTION



SECTION 00621

PAYMENT BOND FORM

KNOW ALL MEN BY THESE PRESENTS: That \_\_\_\_\_ of the City of \_\_\_\_\_ of \_\_\_\_\_ County, and State of \_\_\_\_\_, as principal, and \_\_\_\_\_, authorized under the laws of the State of Texas to act as surety on Bonds for principals, are held and firmly bound unto Waller County (Owner), in the penal sum of \_\_\_\_\_ for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, by these presents:

WHEREAS, the Principal has entered into a certain written contract with the Owner, dated the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_ for \_\_\_\_\_, which Contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall pay all claimants supplying labor and material to him or a Subcontractor in the prosecution of the Work provided for in said contract, then, this obligation shall be void; otherwise to remain in full force and effect;

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

Surety, for value received, stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, or to the Work performed thereunder, or the Plans, Specifications or Drawings accompanying the same, shall in any way affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract, or to the Work to be performed thereunder.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

**Contractor**

**Surety**

\_\_\_\_\_

\_\_\_\_\_

By: \_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

Address: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

The name and address of the Resident Agent of Surety is:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

END OF SECTION

## SECTION 01010

## SUMMARY OF WORK

## PART I GENERAL

## 1.01 DESCRIPTION OF WORK

- A. The work included in this contract for “Waller County Precinct 4 Annex Building Water Plant” includes the following work complete in place as shown on the engineering drawings (12 sheets) prepared by WaterEngineers, Inc. dated 01-23-2020.
1. One dual-string 5-inch SDR 17 PVC cased well with an estimated total depth of 290 feet with an estimated 20 feet of screen with 5 HP submersible pump;
  2. Substantial Completion of entire water plant within 120 days;
  3. Owner to furnish temporary generator for collection of required samples if permanent electrical power is unavailable;
  4. Contractor will furnish and erect a 4,512-gallon Fiberglass Ground Storage Tank (CONCRETE SLAB FOUNDATION CONSTRUCTED BY OTHERS) (See Attachment B-1);
  5. Contractor shall furnish and install one 2,535-gallon Hydropneumatic tank and associated slab (See Attachment B-2);
  6. Two booster pumps with associated intake and discharge headers;
  7. Disinfection chemical storage tank and pumping equipment;
  8. Installation of yard piping and valves;
  9. Electrical and control work to operate the well and booster pumps;
  10. Sitework;
  11. Pressure testing of all piping;
  12. Disinfection and bacterial testing of all new tanks, piping and equipment prior to placing in service; and
  13. All other ancillary tasks or items which are required to complete the project and provide a fully operational and functional system shall be included in the bid.

## 1.02 CONTRACTS AND USE OF SITE

- A. Confine operations at site to areas permitted by:
1. Law
  2. Ordinances
  3. Permits
  4. Contract Documents

- B. Do not unreasonably encumber site with materials or equipment.
- C. Assume full responsibility for protection and safekeeping of products stored on premises.
- D. Obtain written permission for use of additional storage or work areas as needed for operations.
- E. Confine construction activities and the location of employees to areas not in use unless specifically authorized by Owner.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Refer to Specification Sections.

**PART 3 EXECUTION**

- A. Schedule
  - 1. The Contractor shall, prior to notice to proceed, prepare and submit a construction schedule to the Owner for approval. The scope of work shall be scheduled by the Contractor and coordinated with the Owner/Operator to maintain operation of the facilities.
  - 2. The Work shall commence within 10 days of issuance of the Owner's Authorization to Proceed and be Substantially Complete within the calendar days stated in the Proposal.

**END OF SECTION**

## SECTION 01300

## SUBMITTALS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES:

- A. Submittal procedures for:
  - 1. Schedule of Values
  - 2. Construction Schedules
  - 3. Shop Drawings, Product Data, and Sampler
  - 4. Operations and Maintenance Data
  - 5. Manufacturer's Certificates
  - 6. Design Mixes

## 1.02 SUBMITTAL PROCEDURES

- A. Scheduling and Handling
  - 1. Schedule submittals well in advance of the need for the material or equipment for construction. Allow time to make delivery of material or equipment after submittal is approved.
  - 2. Develop a submittal schedule that allows sufficient time for initial review, correction, resubmission and final review of all submittals. The Engineer will review and return submittals to the Contractor as expeditiously as possible but the amount of time required for review will vary depending on the complexity and quantity of data submitted. In no case will a submittal schedule be acceptable which allows less than 10 days for initial review by the Engineer. This time for review shall in no way be justification for delays or additional compensation to the Contractor.

3. The Engineer's review of submittals covers only general conformity to the Drawings, Specifications and dimensions which affect the layout. The Contractor is responsible for quantity determination. No quantities will be verified by the Engineer. The Contractor is responsible for any errors, omissions or deviations from the Contract requirements; review of submittals in no way relieves the Contractor from his obligation to furnish required items according to the Drawings and Specifications.
4. Submit 4 copies of documents unless otherwise specified in the following paragraphs or in the Specifications. One copy of the documents with comments will be returned to contractor.
5. Revise and resubmit submittals as required. Identify all changes made since previous submittal.
6. The Contractor shall assume the risk for material or equipment which is fabricated or delivered prior to approval. No material or equipment shall be incorporated into the Work or included in periodic progress payments until approval has been obtained in the specified manner.

B. Transmittal Form and Numbering

1. Transmit each submittal to the Engineer with a Transmittal Form.
2. Sequentially number each transmittal form beginning with the number 1. Resubmittals shall use the original number with an alphabetic suffix (i.e., 2A for first resubmittal of Submittal 2 or 15C for third resubmittal of Submittal 15). Each submittal shall only contain one type of work, material, or equipment. Mixed submittals will not be accepted.
3. Identify variations from requirements of Contract Documents and identify product or system limitations.

C. Contractor's Stamp

1. Apply Contractor's stamp, certifying that the items have been reviewed in detail and are correct and in accordance with Contract Documents, except as noted by any requested variance.
2. As a minimum, Contractor's Stamp shall include:

- a. Contractor's name
- b. Job number
- c. Submittal number
- d. Certification statement that the Contractor has reviewed the submittal and it is in compliance with the Contract Documents.
- e. Signature line for Contractor

### 1.03 SCHEDULE OF VALUES

- A. Submit a Schedule of Values at least 10 days prior to the first Application for Payment.
- B. Schedule of Values shall be submitted on Engineer's form available in Excel format.
- C. Round off figures for each listed item to the nearest \$100.00 except for the value of one item, if necessary, to make the total price for all items listed in the Schedule of Values equal to the applicable lump sum of the Contract.
- D. Revise the Schedule of Values and resubmit for items affected by Contract Modifications, Change Orders, and Work Change Directives. Submit revised Schedule of Values 10 days prior to the first Application for Payment after the changes are approved by the Engineer.

### 1.04 CONSTRUCTION SCHEDULES

- A. Submit Construction Schedules for the Work in accordance with the requirements of this Section. The Construction Schedule Submittal shall be a bar chart, either computer generated, or prepared manually and a narrative report.
- B. Contractor's Stamp, as described in paragraph 1.02C, shall be placed on each Schedule Submittal.
- C. During the Pre-construction Meeting Contractor shall provide a sample of the format to be used for the Construction Schedule Submittal. The format is subject to approval by the Engineer. Review of the submittal will be provided within 7 days of the submittal of the sample.
- D. Within 7 days of the receipt of approval of the Contractor's format, or 14 days of the Notice to Proceed, whichever is later, the Contractor shall submit a proposed Construction Schedule for review. The Construction Schedule Submittal shall meet the following requirements:

1. The schedule shall usually include a total of at least 20 but not more than 50 activities. Fewer activities may be accepted, if approved by the Engineer.
2. For projects with work at different physical locations or different facilities within a plant site, each location or facility should be indicated separately within the schedule.
3. For projects with multiple crafts or significant subcontractor components, these elements should be indicated separately within the schedule.
4. For projects with multiple types of tasks within the scope, these types of work should be indicated separately within the schedule. For projects with multiple service areas, the Contractor may be required to separate work by service area.
5. For projects with significant major equipment items or materials worth over 30 percent of the Total Contract Price, the schedule shall indicate dates when these items are to be purchased, when they are to be delivered, and when installed.
6. For projects where operating plants are involved, each period of work which will require the shutdown of any process or operation shall be identified in the Schedule and must be agreed to by the Engineer prior to starting work in the area.
7. A graphic or tabular display of the estimated monthly billings for the work shall be prepared and submitted by the Contractor with the first schedule submittal. This information is not required in the monthly updates, unless significant changes in Work require resubmittal of the schedule for review. The display shall allocate the units indicated in the Schedule of Unit Price Work or the Schedule of Values to Construction Schedule activities (weighted allocations are acceptable, where appropriate). The dollar value associated with each allocated unit will be spread across the duration of the activity on a monthly basis. The total for each month and a cumulative total will be indicated. These monthly forecasts are only for planning purposes of the Engineer. Monthly payments for actual work completed will be made by the Engineer in accordance with the Contract Documents.



- E. The Contractor must receive approval of the Engineer for the Schedule and billing curve prior to the first monthly Application for Payment. No payment will be made until the Schedule and billing curve are accepted.
- F. If the Contractor desires to make changes in his method of operating and scheduling after approval of the original planned operations schedule has been given by the Engineer, the Contractor shall notify the Engineer in writing, stating the reasons for the change. If the Engineer considers these changes to be of significant nature, the Contractor may be required to revise and resubmit for approval all or the affected portion of the Contractor's Construction Schedule to show the effect on the entire Work.
- G. Upon written request from the Engineer, the Contractor shall revise and submit for approval all or any part of the Construction Schedule to reflect changed conditions in the Work or deviations made from the original plan and schedule.
- H. The Contractor's Construction Schedule shall thereafter be updated with the Actual Start and Actual Finish Dates, Percent Complete, and Remaining Duration of each Activity and submitted monthly. The data date to be used in updating the monthly Construction Schedule shall be the same Data Date as is used in the monthly Application for Payment. This monthly update of the schedule shall be required before the monthly Application for Payment will be processed for payment.
- I. The narrative Schedule Report shall include a description of changes made to the Construction Schedule; Activities Added to the Schedule; Activities Deleted from the Schedule; any other changes made to the Schedule other than the addition of Actual Start Dates and Actual Finish Dates and changes of Data Date and Remaining Durations.

#### 1.05 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

- A. Shop Drawings
  - 1. Submit shop drawings for review as required by the Specifications. Shop drawings shall be reviewed and signed by the Contractor.
  - 2. Contractor's Stamp, as described in paragraph 1.02C, shall be placed on each drawing.
  - 3. The drawings shall accurately and distinctly present the following:
    - a. Field and erection dimensions clearly identified as such
    - b. Arrangement and section views

- c. Relation to adjacent materials or structure including complete information for making connections between work under this Contract and work under other contracts
  - d. Kinds of materials and finishes
  - e. Parts list and descriptions
  - f. Assembly drawings of equipment components and accessories showing their respective positions and relationships to the complete equipment package
  - g. Where necessary for clarity, identify details by reference to drawing sheet and detail numbers, schedule or room numbers as shown on the Contract Drawings.
4. Drawings shall be to scale, and shall be a true representation of the specific equipment or item to be furnished.

B. Product Data

1. Submit product data for review as required in Specification sections.
2. Contractor's Stamp, as described in paragraph 1.02C, shall be placed on each data item submitted.
3. Mark each copy to identify applicable products, models, options to be used in this Project. Supplement manufacturers' standard data to provide information unique to this Project, where required by the Specifications.
4. For products specified only by reference standard, give manufacturers, trade name, model or catalog designation and applicable reference standard.

1.06 OPERATIONS AND MAINTENANCE DATA

- A. When specified in Specification sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, operation, adjusting, finishing, and maintenance.
- B. Contractor's Stamp, as described in paragraph 1.02C, shall be placed on front page of each document.
- C. Identify conflicts between manufacturers' instructions and Contract Documents.

1.07 MANUFACTURER'S CERTIFICATES

- A. When specified in Specification sections, submit manufacturers' certificate of compliance for review by Engineer.

- B. Contractor's Stamp, as described in paragraph 1.02C, shall be placed on front page of the certification.
- C. Submit supporting reference data, affidavits, and certifications as appropriate.
- D. Certificates may be recent or previous test results on material or product, but must be acceptable to Engineer.

#### 1.08 DESIGN MIXES

- A. When specified in Specifications, submit design mixes for review.
- B. Contractor's Stamp, as described in paragraph 1.02C, shall be placed on front page of each design mix.
- C. Mark each design mix to identify proportions, gradations, and additives for each class and type of design mix submitted. Include applicable test results on samples for each mix.
- D. Maintain a copy of approved design mixes at mixing plant.

PART 2 PRODUCTS  
Not Used

PART 3 EXECUTION  
Not Used

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1     G E N E R A L

1.01    SECTION INCLUDES

- A.     Requirements for transportation, delivery, handling, and storage of materials and equipment.

1.02    PRODUCTS

- B.     Products: Means material, equipment, or systems forming the Work. 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.
- C.     Do not reuse materials and equipment, designated to be removed, except as specified by the Contract Documents.
- D.     Provide equipment and components from the fewest number of manufacturers as is 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 project.

1.03    TRANSPORTATION

- E.     Make arrangements for transportation, delivery, and handling of equipment and materials required for timely completion of the Work.
- F.     Transport and handle products in accordance with manufacturer's instructions.
- G.     Consign and address shipping documents to the proper party giving name of Project, street number, and City. Shipments shall be delivered to the Contractor.

1.04    DELIVERY

- A.     Arrange deliveries of products in accord with construction schedules and in ample time to facilitate inspection prior to installation. Avoid deliveries that cause lengthy storage or overburden of limited storage space.
- B.     Coordinate deliveries to avoid conflict with Work and conditions at the site and to accommodate the following:
  - 1.     Work of other contractors or the Owner.
  - 2.     Limitations of storage space.

3. Availability of equipment and personnel for handling products.
  4. Owner's use of premises.
- C. Have products delivered to the project site only after related Shop Drawings have been reviewed by the Engineer.
- D. Have products delivered to the site when adequate storage facilities have been provided.
- E. Have products delivered to the site in manufacturer's original, unopened, labeled containers. Keep the Engineer informed of delivery schedules for equipment to be incorporated in the Work.
- F. Clearly mark partial deliveries of component parts of equipment to identify the equipment, to permit easy accumulation of parts, and to facilitate assembly.
- G. Immediately upon delivery, inspect shipment to assure:
1. Product complies with requirements of Contract Documents and reviewed submittals.
  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 the off-loading of materials and equipment delivered to the job site. If necessary to move stored materials and equipment during construction, Contractor shall relocate materials and equipment at no additional cost to the Owner.
- B. Provide equipment and personnel necessary to handle products, including those provided by the Owner, by methods to prevent soiling or damage to products or packaging.
- C. Provide additional protection during handling as necessary to prevent scraping, marring, or otherwise damaging products or surrounding surfaces.
- D. Handle products by methods to prevent bending or over stressing.
- E. Lift heavy components only at designated lifting points.
- F. Handle materials and equipment 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 STORAGE OF MATERIAL

- A. Store and protect materials in accordance with manufacturer's recommendations and requirements of these Specifications.
- B. Make necessary provisions for safe storage of materials and equipment. Place excavated materials, construction equipment, and materials and equipment to be incorporated into the Work 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 materials and equipment neatly and compactly stored in locations that will cause a minimum of inconvenience to other contractors, public travel, adjoining owners, tenants, and occupants. Arrange storage in a manner to provide easy access for inspection.
- C. Restrict storage to areas available on the construction site for storage of material and equipment as shown on Drawings or approved by the Engineer.
- D. Provide off-site storage and protection when on-site storage is not adequate.
- E. Do not use lawns, grass plots, or other private property for storage purposes without written permission of the owner or other person in possession or control of such premises.
- F. Protect stored materials and equipment against loss or damage.
- G. Store in manufacturers' unopened containers.
- H. Materials delivered and stored shall be neatly, safely, and compactly stacked along the work site in such manner as to cause the least inconvenience and damage to property owners and the general public, and shall be not closer than 3 feet to any fire hydrant. Public and private drives and street crossings shall be kept open.
- I. Damage to lawns, sidewalks, streets or other improvements shall be repaired or replaced to the satisfaction of the Engineer.

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

E N D O F S E C T I O N

SECTION 02223

EXCAVATING, TRENCHING AND BACKFILLING FOR PIPE

PART 1 - GENERAL

1.01 QUALITY ASSURANCE

A. Laboratory Quality Control by Contractor:

1. Establish optimum moisture-maximum density curve for bedding and backfill material, ASTM D 698; for those soils which will not exhibit a well-defined moisture-density relationship, determine optimum relative density, ASTM D 4253 and D 4254.
2. Establish optimum moisture-maximum density curve, ASTM D 698; Atterberg Limits, ASTM D 4318; and sieve analysis, ASTM D 422 for following:
  - a. Borrow bedding and backfill material to be used.
  - b. Excavated material of questionable suitability for use as bedding and backfill material.
3. One optimum moisture-maximum density curve, ASTM D 698, shall be established for each significant change in materials.
4. Bedding and backfill materials which do not meet specified requirements shall be replaced with suitable materials.

B. Field Quality Control by Owner:

1. Laboratory density testing of trench backfill:
  - a. One field in-place density test per 500 lin. ft. of trench.
  - b. One field in-place density test per 150 lin. ft. of trench for each fill layer under existing or proposed paved areas and at least one test per fill layer at each road crossing.
2. Laboratory density testing of general fill: One field in-place density test per 100 cu. yd. of fill placed.
3. Field in-place density tests shall be in compliance with ASTM D 1556, ASTM D 2922, or ASTM D 2167.

- C. If, during progress of work, tests indicate that compacted materials do not pass specified requirements, work shall be removed, replaced, and retested at no cost to Owner.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

#### A. Suitable bedding and Backfill Materials:

##### 1. Sand for pipe bedding:

- a. Plasticity index: 7 maximum, ASTM D 4318.
- b. 100 percent passing 1/2 in. standard sieve and 15 percent maximum passing No. 200 sieve, ASTM C 136 and C 117.
- c. Free of clay lumps, organic material, salt, or other deleterious substances.

##### 2. Material for trench backfill:

- a. Select sandy soil or other granular material.
- b. Plasticity index: 11 maximum, ASTM D 4318.
- c. 100 percent passing 1 in. standard sieve and 30 percent maximum passing No. 200 sieve, ASTM C 136 and C 117.
- d. Free of clay lumps, organic material, salt, or other deleterious substances.

#### B. Cement Stabilized Sand:

##### 1. Mixture of sand and portland cement: One sack of specified portland cement per ton (2000 lb.) of specified sand for subgrade for sewer pipe and culverts.

##### 2. Use two sacks of portland cement per cu. yd. sand for sanitary sewer pipe embedment 9 ft. each side of crossing under water line when sanitary sewer pipe material is ABS truss pipe, clay or concrete pipe with gasketed joints.

##### 3. Sand:

- a. Clean durable sand, free of lumps of clay, organic material, salt or other deleterious substances.
- b. Plasticity index: 6 maximum (of materials passing No. 200 sieve), ASTM D 4318.
- c. 100 percent passing 3/8 in. sieve, ASTM C 136.
- d. 5 percent to 25 percent passing No. 50 sieve, ASTM C 136.
- e. 5 percent maximum passing No. 200 sieve, ASTM C 117.



4. Portland cement: ASTM C 150, Type I.
  5. Do not use mixture which has dried out or lost moisture content.
- C. Trench Bottom Special Reinforcement Backfill: Washed gravel or crushed stone.

### PART 3 – EXECUTION

#### 3.01 PREPARATION

Refer to Section 02000.

#### 3.02 GENERAL

- A. Work includes excavating, trenching, and backfilling for pipe.
- B. Work includes as incidental to construction, clearing of trenching areas, salvaging of topsoil and stockpiling, and construction required in crossing continued utilities, such as support of lines while trenching through, and capping and sealing, and removal of discontinued utilities within excavated areas and restoration.
- C. Make open cut excavations to required lines and grades.
- D. No extra compensation will be made because of subsurface soil conditions requiring removal of rock, boulders, hard-pan or other classes of excavation; materials shall be excavated as required by construction without claim for extra compensation because of subsurface soil conditions.
- E. Excavate adequate but not excessive working space and clearances for installation of work and form removal.
- F. Allow not less than 6 in. clearance in horizontal dimensions of excavations for outside plastering of manholes and similar structures constructed of masonry units.
- G. Do not undercut excavation faces for extended footings of structures.
- H. Clear subgrade surfaces of loose material before placing concrete or bedding materials.
- I. Backfill with specified suitable materials unless otherwise shown on Drawings, specified, or authorized.
- J. Remove from site and legally dispose of excavated materials not suitable for backfill.

- K. Do not damage pipe or disturb jointing or alignment during backfilling operations.
- L. Excavate by hand within 2 ft. of existing utilities to remain.

### 3.03 CLASSIFICATION OF EXCAVATED MATERIALS

- A. Excavated materials will be unclassified.
- B. Excavate materials encountered without exception.

### 3.04 BLASTING

- A. Use of explosives will not be permitted.

### 3.05 REMOVAL OF WATER

- A. Provide and maintain adequate pumping system in trenches and excavations to collect, remove, and dispose of surface and ground water entering excavations and trenches.
- B. Keep excavations dry continually during preparation of subgrade and until structure or piping is completed to extend that no damage from hydrostatic pressure, floatation, or other water related causes will result.
- C. Divert surface water away from excavated areas and prevent water from entering excavations.
- D. Where excavations for trenches or concrete structures extend down below static ground water elevations, prevent ground water boiling up through trench bottom, loosening up, and flooding trench subgrade; lower and maintain ground water surface to depth not less than 12 in. below bottom of excavation by installing series of well points, pumping and collecting system, and approved discharge and disposal system.
- E. Maintain sewers used for drainage purposes in usable conditions; leave clean and free from sediment and obstacles at completion of work.

### 3.06 SHEETING AND SHORING

- A. Except where banks are cut back on stable slope, sheet, brace, and shore excavations for trenches and structures.
- B. When sheeting, bracing and shoring are necessary, construct sheeting, bracing, and shoring to withstand loads caused by earth movement and construction operations.

1. Maintain shape and position of sheeting, bracing, and shoring for duration necessary.
2. Remove sheeting, bracing, and shoring when not needed.

### 3.07 SUBGRADE PREPARATION

- A. Trench bottoms and subgrade surfaces for concrete structures shall be free from mud and muck, and shall be firm, dense, and compacted and consolidated to degree of remaining firm and intact under feet of workmen.
- B. Remove peat, muck, quicksand, or other unstable material encountered at and below subgrade to depth 1 ft. below subgrade or depth equal to diameter of pipe for pipe larger than 1 ft.; backfill with sand or gravel compacted to maximum density or concrete.
- C. Where rock or other incompressible material is encountered, remove material to depth 6 in. below subgrade and backfill with tamped sand, gravel, or concrete.
- D. Reinforce trench bottoms or subgrade surfaces for concrete structures which are solid, but which become mucky on top due to construction operations with specified sand.
- E. Use only sand or gravel compacted to maximum density, or concrete to bring fills to lines and grades indicated and for replacing unsatisfactory materials.
- F. Special Trench Bottom Reinforcement: If foundation on which pipe is to be laid is excessively wet, excavate trench to minimum of 6 in. below outside bottom surface of pipe and fill with washed gravel or crushed stone.

### 3.08 EXCAVATION

- A. Do not keep open more than 100 ft. of trench on any line under construction.
- B. Open cut excavation from surfaces unless tunneling or boring and jacking operations are indicated.
- C. Alignment and Grade:
  1. Fix and determine alignment and grade or elevation of each pipe line by using offset stakes.
  2. Vertical and horizontal alignment of pipes and maximum joint deflection used shall be in conformity with requirements of pipe being laid.
  3. Laser equipment may be used to set line and grade provided manufacturer's procedures are followed and accuracy is maintained.

4. Employ surveyor to periodically check and document correct grade and alignment of pipe laid with laser equipment.

D. Trenching:

1. Where trenches for sanitary sewers have been excavated below 10 ft. depth, pipe shall be on 6 in. minimum bed of cement stabilized sand with cradle of cement stabilized sand carried up to springline of pipe.
2. Make vertical sides in bedding zone; slope sides at stable slope above top of pipe.
3. Where trench hoe is used, do not use excavated material composed of large chunks and clods for backfill.
4. Dispose of large chunks and clods as waste materials and provide suitable backfill material.
5. Excavated trench material to be replaced in trench as backfill, shall be well broken up and moisture content shall not exceed 3 percent above optimum moisture content as determined by ASTM D 698.

E. Trench Widths:

1. Trenches for pipe sewers smaller than 30 in. pipe shall have width below top of pipe not less than outside diameter plus 12 in. and not more than outside diameter of pipe plus 18 in.
2. Trench widths for special jointing shall meet requirements of pipe materials manufacturer.
3. Trench widths below tops of pipe bells may be increased by an amount to permit sheathing and bracing timbers and to permit installation of well points and pumps in trench where sump pumping is uneconomical.
4. Provide space between cross braces to permit handling of forms, pipe, and other materials.

F. Do no obstruct drainage during handling of excavated material.

G. Unauthorized Trench Widths: Where trench width below top of pipe exceeds maximum permitted, provide pipe of adequate strength, arch concrete encasement, or special pipe embedment designed with safety factor of 2 and selected to satisfy loading conditions.

H. Joint Holes:

1. Provide adequate clearance for tools and jointing operations.
2. Do not allow part of joint or coupling to contact trench bottom or trench wall when pipe is jointed.

3.09 PIPE ENVELOPE

- A. Pipe shall be bedded as shown in pipe envelope details on Drawings.
- B. Use specified sand for pipe envelope where sand envelope is shown.
- C. Use specified cement stabilized sand for pipe envelope and backfill where shown.

3.10 TRENCH BACKFILL

- A. Do not backfill with wet, mucky, or unsuitable materials or with large rocks or clods of material.
- B. Trench backfill above pipe embedment shall conform to requirements for type and location of pipe.

3.11 BACKFILL AT MANHOLES, JUNCTION BOXES

- A. Place backfill in 8 in. maximum layers around structures and compact to density of adjacent undisturbed materials.
- B. Backfill material shall not contain wood, grass, roots, broken concrete, stones, trash, or debris.
- C. Do not deposit or compact backfill by flooding.

3.12 DRAINAGE MAINTENANCE

- A. Start backfilling operations upstream for trenches crossing highways, streets, driveways adjacent to drainage ditches, and water courses; proceed downstream to prevent impounding of water.
- B. Do not allow water to accumulate in uncompleted trenches.
- C. Remove material deposited in ditch or water course crossed by trench excavation immediately after completion of backfill.
- D. Restore section, grades, and contours of ditches or water courses to original condition.

3.13 UNSUITABLE AND EXCESS MATERIALS

- A. Dispose of unsuitable excavated materials off-site in legal manner.
- B. Suitable excess excavated material shall remain property of Owner to be stockpiled or spread at locations as directed.

3.14 FINISHING AND GRADING

- A. Uniformly grade disturbed areas smooth so areas match adjacent undisturbed natural ground and fit into drainage pattern of surrounding areas.
- B. For areas previously finished to proposed established grade and cross section, finish surface within 0.10 ft. above or below required grade and cross section.
- C. Finish ditches and gutters to drain.

3.15 RESTORATION

- A. Unless disturbed areas and excavation areas are scheduled for subsequent construction, restore as follows, as incidental to construction:
  - 1. Replace 4 in. depth of topsoil from stockpiles of topsoil formed during preparation operations.
  - 2. Provide hauled-in topsoil as necessary.
  - 3. For excavation and disturbed areas sodded prior to construction, re-sod to match pre-existing conditions.

END OF SECTION

SECTION 02620

POLYVINYL CHLORIDE PIPE

PART 1      G E N E R A L

1.01      SECTION INCLUDES

- A.      Polyvinyl chloride (PVC) pressure pipe for water distribution in nominal diameters 2-inches through 60-inches.

1.02      REFERENCES – The latest published versions of the referenced standards shall apply.

- A.      ANSI A21.5 (AWWA C105) - Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.
- B.      ANSI A21.10 (AWWA C110) - Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. for Water and Other Liquids.
- C.      ANSI A21.11 (AWWA C111) - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- D.      ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compound and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- E.      ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC Plastic Pipe (SDR-PR), cell classification 12545-B or 12454-C, SDR 21 or smaller, and pressure class of 200 psi or greater.
- F.      ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- G.      AWWA C900- Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 60 in. for Water Distribution.
- H.      UNI-B-13 - Recommended Standard Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride (PVC) Pipe.

1.03      SUBMITTALS

- A.      Submittals shall conform to requirements of Section 01300 - Submittals.
- B.      Submit shop drawings showing design of new pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fittings, flanges, and special details.

1.04      QUALITY CONTROL

- A.      Submit manufacturer's affidavit that PVC pipe meets requirements of AWWA C900 for pressure pipe applications.

- B. Submit manufacturer's certification that PVC pipe have been hydrostatically tested at factory in accordance with AWWA C900 and this Section.

## PART 2      P R O D U C T S

### 2.01      M A T E R I A L

- A. All products and material that come into contact with potable water must conform to ANSI/NSF Standard 61 and must bear the National Sanitation Foundation Seal of Approval (NSF-pw).
- B. PVC compounds used to manufacture pipe shall contain no ingredient in an amount that has been demonstrated to migrate into water in quantities considered to be toxic.
- C. For PVC pressure pipe, manufacture PVC pipe from Class 12454-A or Class 12454-B virgin compounds as defined in ASTM D1784. Compounds shall qualify for a rating of 4000 psi for water at 73.4 degrees F per requirements of PPITR3. Provide pipe which is homogeneous throughout, free of voids, cracks, inclusions and other defects, uniform as commercially practical in color, density and other physical properties. Deliver pipe with surfaces free from nicks and scratches with joining surfaces of spigots and joints free from gouges and imperfections which could cause leakage.
- D. For PVC pressure pipe used for water mains, PVC pipe shall be self-extinguishing and bear Underwriters' Laboratories mark of approval that is acceptable without penalty to Texas State Fire Insurance Committee for use in fire protection lines.
- E. Lubricant for rubber-gasketed joints: Water soluble, non-toxic, non-objectionable in taste and odor imparted to fluid, non-supporting of bacteria growth, have no deteriorating effect on PVC or rubber gaskets.
- F. Lead Ban: The use of pipes, pipe fittings, plumbing fittings and fixtures that contain more than 0.25 percent lead is prohibited:

### 2.02      W A T E R   S E R V I C E   P I P E

- A. Pipe 2-inch through 3-inch: ASTM D2241, Cell Classification 12454-B or 12454-C, SDR 21 or smaller, and pressure class of 200 psi or greater; nominal 20-foot lengths.
- B. Pipe 4-inch through 12-inch: AWWA C900, Class 200, DR 18; nominal 21-foot lengths.
- C. Pipe 14-inch through 60-inch: AWWA C900; Class 235; DR 18; nominal 20-foot lengths.
- D. Joints: ASTM D3139; push-on type joints in integral bell or separate sleeve couplings. Gaskets and seals: ASTM F477; elastomeric; factory installed and glued in place; sole element depended upon to make joints flexible and watertight. Do not use socket type or solvent weld type joints.
- E. Make curves and bends by deflecting the joints. Do not exceed maximum deflection recommended by the pipe manufacturer. Submit details of other methods of providing curves and bends for review by Engineer.



- F. Hydrostatic Test: AWWA C900, AWWA C110; at point of manufacture; submit manufacturer's written certification.

2.03 PVC PRESSURE PIPE FOR BENDS AND FITTINGS

- A. Bends and Fittings: ANSI A21.10; ductile iron; ANSI A21.11 single rubber gasket push-on type joint; minimum 150 psi pressure rating.
- B. ANSI A21.5; provide minimum 8-mil thickness polyethylene wrapping.
- C. Line fittings with epoxy coating, 24-mil minimum dry film thickness applied in three applications.

PART 3 EXECUTION

3.01 PROTECTION

- A. Store pipe under cover out of direct sunlight and protect from excessive heat or harmful chemicals in accordance with the manufacturer's recommendations.

3.02 INSTALLATION

- A. Install PVC pipe in accordance with ASTM D2321 and manufacturer's recommendations.
- B. Water service pipe 12 inches in diameter and smaller: Installed to clear utility lines and have minimum 4 feet of cover below lowest property line grade of street, unless otherwise required by Drawings.
- C. Avoid imposing strains that will overstress or buckle the pipe when lowering pipe into trench.
- D. Hand shovel slice bedding under the pipe haunches and along the sides of the pipe barrel to eliminate voids and ensure side support.

3.03 HYDROSTATIC LEAKAGE RATE

- A. The hydrostatic leakage rate for polyvinyl chloride (PVC) pipe and appurtenances shall not exceed the amount allowed or recommended by formulas in AWWA Standard C-605 as required in 30 TAC §290.44(a)(5);

$$Q = \frac{LD\sqrt{P}}{148,000}$$

Where:

- Q = the quantity of makeup water in gallons per hour,
- L = the length of the pipe section being tested, in feet,
- D = the nominal diameter of the pipe in inches, and
- P = the average test pressure during the hydrostatic test in pounds per square inch (psi).

END OF SECTION

SECTION 02621

POLYVINYL CHLORIDE PIPE (PRESSURE)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Polyvinyl chloride (PVC) pressure pipe for water distribution and sanitary sewers in nominal diameters 4 inches through 24 inches.

1.02 REFERENCES

- A. ANSI A21.5 (AWWA C105) - Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.
- B. ANSI A21.10 (AWWA C110) - Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. for Water and Other Liquids.
- C. ANSI A21.11 (AWWA C111) - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- D. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compound and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- E. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC Plastic Pipe (SDR-PR)
- F. ASTM D3034 - Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- G. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- H. ASTM D3212 - Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- I. ASTM F477 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- J. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 12 in. for Water Distribution.
- K. UNI-B-13 - Recommended Standard Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride (PVC) Pipe.

1.03 QUALITY CONTROL

- A. Submit manufacturer's affidavit that PVC pipe meets requirements of AWWA C900 or AWWA C905 for pressure pipe applications or ASTM D3034 for gravity sewer applications.
- B. Submit manufacturer's certification that PVC pipe have been hydrostatically tested at factory in accordance with AWWA C900 or C905 and this Section.

PART 2 PRODUCTS

2.01 MATERIAL

- A. PVC compounds used to manufacture pipe shall contain no ingredient in an amount that has been demonstrated to migrate into water in quantities considered to be toxic.
- B. For PVC pressure pipe, manufacture PVC pipe from Class 12454-A or Class 12454-B virgin compounds as defined in ASTM D1784. Compounds shall qualify for a rating of 4000 psi for water at 73.4 degrees F per requirements of PPITR3. Provide pipe which is homogeneous throughout, free of voids, cracks, inclusions and other defects, uniform as commercially practical in color, density and other physical properties. Deliver pipe with surfaces free from nicks and scratches with joining surfaces of spigots and joints free from gouges and imperfections which could cause leakage.
- C. For PVC pressure pipe used for water mains, PVC pipe shall be self-extinguishing and bear Underwriters' Laboratories mark of approval that is acceptable without penalty to Texas State Fire Insurance Committee for use in fire protection lines.
- D. Lubricant for rubber-gasketed joints: Water soluble, non-toxic, non-objectionable in taste and odor imparted to fluid, non-supporting of bacteria growth, have no deteriorating effect on PVC or rubber gaskets.

2.02 PVC PRESSURE PIPE FOR BENDS AND FITTINGS

- A. Bends and Fittings: ANSI A21.10; ductile iron; ANSI A21.11 single rubber gasket push-on type joint; minimum 150 psi pressure rating.
- B. ANSI A21.5; provide minimum 8-mil thickness polyethylene wrapping.
- C. Line fittings with epoxy coating, 24-mil minimum dry film thickness applied in three applications.

2.03 GRAVITY SANITARY SEWER PIPE

- A. PVC gravity sanitary sewer pipe shall be in accordance with the provisions in the following table:

Wall Construction	Manufacturer	Product Options	ASTM Designation	SDR/Stiffness (Min.)	Diameter Range
Solid		Approved equal	D2241	SDR 26	6" to 10"
		Approved equal	D3034	SDR 35	12" & 15"
		Approved equal	F679	SDR 35	18" to 27"

- B. Maximum allowable pipe deflection after installation and backfill shall be 5 percent.
- C. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D3212, factory-assembled and securely locked or glued in place to prevent displacement. The manufacturer shall test a sample from each batch conforming to requirements ASTM D2444. Connections including wyes, tees, stacks, and stubs shall be full bodied.
- D. Fittings: Provide PVC gravity sewer sanitary wye fittings for new sanitary sewer construction. Saddle-type wye fittings are not acceptable.

2.04 SANITARY SEWER FORCE MAIN PIPE

- A. PVC pressure pipe and fittings shall conform to Uni-B-11 for Polyvinyl Pressure Pipe (AWWA C900 and AWWA C905). Pipe shall be pressure rated to 150 psi.
- B. All pipe and fitting joints shall be integral bell and spigot, containing a bonded-in elastomeric sealing ring meeting the requirements of ASTM F477. In designated areas requiring restrained joint pipe and fittings, use Uniflange Series 1350 restrainer, or equal joint restraint device conforming to Uni-B-13.
- C. Fittings: Provide ductile iron fittings as per Paragraph 2.03.
- D. Hydrostatic Tests: Hydrostatically test pipe as per Paragraph 2.02 E.

**PART 3 EXECUTION**

**3.01 PROTECTION**

- A. Store pipe under cover out of direct sunlight and protect from excessive heat or harmful chemicals in accordance with the manufacturer's recommendations.

**3.02 INSTALLATION**

- A. Conform to requirements of Section 02730 - Gravity Sanitary Sewers, and 02731 - Sanitary Sewage Force Mains, if included.
- B. Install PVC pipe in accordance with ASTM D2321 and manufacturer's recommendations.
- C. Avoid imposing strains that will overstress or buckle the pipe when lowering pipe into trench.
- D. Hand shovel slice bedding under the pipe haunches and along the sides of the pipe barrel to eliminate voids and ensure side support.

**END OF SECTION**

SECTION 02831

CHAIN LINK FENCING AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fencing and gate components constructed with galvanized ferrous components.

1.02 SUBMITTALS

- A. Submit evidence of meeting erector qualifications.
- B. Product Data: Submit manufacturer's descriptive literature for fencing and gates components
- C. Shop Drawings:
  - 1. Submit manufacturer's construction and detail drawings for installation.
  - 2. Submit layout (grid) drawings for installation.
  - 3. Submit manufacturer's installation instructions.

1.03 QUALITY ASSURANCE

- A. Erector shall have minimum of two years experience installing similar fencing and gates, or have completed at least ten equivalent installations.
- B. Weight of zinc coating on ferrous components shall be tested in compliance with ASTM A 90 when requested.
- C. Apply zinc coating to ferrous components in accordance with recommendations of ASTM A 385.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Acco Industries, Page Fence Division.
- B. U. S. Steel Company, Cyclone Fence Div.
- C. Hurricane Industries, Houston, Texas.

2.02 MATERIALS

- A. Steel Pipe Framework: ASTM A53, Schedule 40, hot-dip galvanized 2.0 oz. per sq.ft.
- B. Chain Link Fabric (Mesh): Comply with FS RR-F-191/1, Type I, hot-dip galvanized 1.2 oz. per sq.ft.

- C. Miscellaneous Ferrous Components: Hot-dip galvanized to weights per sq.ft. as specified in FS RR-F-191/1, /2, /3, and /4 in compliance with ASTM A 123 and recommendations of ASTM A 385.

### 2.03 CONCRETE MIX

- A. Refer to Section 03300.

### 2.04 COMPONENTS

A. Fabric:

1. 2 in. diamond mesh.
2. 11 ga.

B. Corner and Terminal Posts:

1. Nominal pipe size (NPS): 2.5 in.
2. Outside diameter (o.d.): 2.875 in.
3. Weight: 5.79 lb. per lin. ft.

C. Line Posts and Brace Posts:

1. Nominal pipe size (NPS): 2 in.
2. Outside diameter (o.d.): 2.375 in.
3. Weight: 3.65 lb. per lin. ft.

D. Gate Posts:

1. Nominal pipe size (NPS): 3.5 in.
2. Outside diameter (o.d.): 4.0 in.
3. Weight: 9.11 lb. per lin. ft.

E. Top Rail:

1. Nominal pipe size (NPS): 1.25 in.
2. Outside diameter (o.d.): 1.625 in.
3. Weight: 2.27 lb. per lin. ft.

F. Horizontal and Diagonal Brace Rails:

1. Nominal pipe size (NPS): 1.25 in.
2. Outside diameter (o.d.): 1.660 in.
3. Weight: 2.27 lb. per lin. ft.

G. Welded Pipe Gate Perimeter Frame and Fabric:

1. Nominal pipe size (NPS): 1-1/2 in.
2. Outside diameter (o.d.): 1.90 in.
3. Weight: 2.72 lb. per lin. ft.
4. Type of gates: As shown on Drawings.
5. Design and construction of gates: As shown on Drawings.
6. Fabrication of gates after zinc-coating parts shall require welds of joints to be properly prepared and painted with zinc-rich paint.
7. Type of fabric, size of mesh, size of wire, type of coating, and selvage of fabric of gates shall match that of fencing.
8. Design of barbed wire mounting on gates shall be as shown on Drawings.

H. Post Caps:

1. When top rail is specified, provide caps which have ring or hole suitable for passage of top rail.

2. Caps shall be formed steel or malleable iron, galvanized; cast iron; or alloy aluminum; set screw retained.
- I. Top Rail Ends and Brace Rail Ends: Formed steel or malleable iron galvanized; cast iron; or alloy aluminum.
- J. Top Rail Sleeves (Couplings):
  1. Allow for expansion and contraction of top rail.
  2. Same material as top rail with minimum length of 6 in.
- K. Wire Ties: Gage shall match gage of fencing fabric, of same material and coating or aluminum, 6 ga.
- L. Brace Rail Holding Bands and Tension Bar Holding Bands: Galvanized steel, 3/4 in. by 1/10 in minimum.
- M. Tension Bars:
  1. Galvanized steel 3/4 in. by 3/16 in. minimum.
  2. One piece to full height of fabric.
- N. Steel Tension Wire:
  1. Marcellled or crimped coil spring hard tempered carbon steel wire.
  2. Minimum tensile strength: 75,000 psi.
  3. Zinc-coated 1.2 oz. per sq. ft. minimum.
  4. 6 ga. wire.
- O. Truss Rods: Galvanized steel, 3/8 in. minimum diameter.
- P. Steel Barbed Wire Strands:
  1. Three 12 1/2 ga. twisted line wires.
  2. Four-point 14 ga. barbs approximately 5 in. o.c.
  3. Hot-dip galvanized after weaving.
  4. Comply with ASTM A 121, Class 3.
- Q. Barbed Wire Support Arms:
  1. Single-arm type for three barbed wire strands.
  2. When installed, each support arm shall project at angle of approximately 45 deg. outward from plane of fence and outermost strand shall be positioned approximately 12 in. outward and 12 in. above top of fabric.
  3. When top rail is specified, arm base shall be designed to permit passage of top rail.
  4. Pressed steel firmly attached to base cap for post and capable of supporting 300 lb. load at end of arm.
- R. Miscellaneous Accessories: Bolts, nuts, and washers shall be galvanized steel or aluminum alloy.
- S. Gate Hardware:
  1. Single swing gate latch:
    - a. Fork type, gravity drop bar type or plunger bar type with padlocking features.
    - b. Drip or plunger bar shall be full gate height.
  2. Double swing gate latch:
    - a. Fork type, gravity drop type of plunger bar type with padlocking features.
    - b. Drop or plunger bar shall be full gate height.



- c. Provide gate stop set in concrete at finished grade level to anchor center drop rod or plunger.
- d. Provide mechanical device keeper for each gate leaf to secure free ends of double swing gate in full open position.

3. Hinges:

- a. Provide gate hinges of adequate strength galvanized steel to hold each gate.
- b. Hinges shall have large bearing areas for clamping or bolting into position.
- c. Hinge action shall allow each gate to be easily opened or closed by one person.
- d. Hinges shall provide full 180 deg. swing of gate leaf.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Verify that final grading in fence location is completed without irregularities which would interfere with fence installation.
- B. Measure and lay out complete fence line.
- C. Measure parallel to surface of ground.
- D. Locate and mark position of posts.
  1. Locate line posts at equal distance spacing, not exceeding 10 ft. o.c.
  2. Locate corner posts at positions where fence changes direction more than 10 deg.
  3. Locate braced terminal posts at abrupt changes in grade and at fence ends.

### 3.02 INSTALLATION

- A. Auger excavations for cast-in-place concrete bases for posts.
- B. Posts shall be anchored in concrete bases as follows:
  1. Minimum post base diameter and minimum post base depth shall be as shown on Drawings.
  2. Set post plumb.
  3. Fill hole with concrete to 2 in. above grade.
  4. Crown surface of concrete to slope away from post.
  5. Posts may be set in concrete footings by use of sleeves, ASTM F 567.
- C. Top Rail: Install top rail regardless of fence height
- D. Install diagonal braces on gates and panels adjacent to gate posts, terminal posts, and corner posts.
  1. Diagonal braces shall be securely fastened to post and to adjacent line post or to adjacent line post footing or to footing of equal size.
  2. Install diagonal braces with no more than 50 deg. angle with ground.
  3. Put each diagonal brace in compression by use of tension bar and turnbuckle installed diagonally from corner to corner of panel at angle to brace.

4. Attach brace to terminal post at halfway point of terminal post.
- E. Fence Fabrics:
1. Stretch fabric tight between terminal or corner posts.
  2. Position bottom of fabric 2 in. above ground level at each post.
  3. Cut fabric to form one continuous piece between terminal or corner posts.
  4. Attach fabric to terminal or corner post using tension bars and tension bands:
    - a. Thread tension bars through fabric.
    - b. Tension band spacing not to exceed 15 in. o.c.
  5. Attach fabric to line posts using wire ties or clips, spacing not to exceed 24 in. o.c.
  6. Attach top edge of fabric to top rail using wire ties or clips, spacing 24 in. o.c. maximum.
  7. Attach bottom edge of fabric to bottom tension wire using wire ties or clips, spacing not to exceed 24 in o.c.
- F. Tension Wire:
1. Fasten bottom tension wire within bottom 6 in. of fabric.
  2. Pass top tension wire through holes drilled in line posts and fasten securely at terminal posts.
  3. Tension wire shall be taut and free from sag.
- G. Extension Arms: Set at outward angle of approximately 45 deg. on fence and vertical on gates.
- H. Gates:
1. Install gates to open as shown on drawings.
  2. Install gates plumb and level.
  3. Install ground-set items in concrete.
  4. Adjust hardware to provide smooth operation.

### 3.03 GROUNDING

- A. Ground fencing and gates as specified as incidental to construction.
- B. Ground fence at least every 500 ft.
- C. Each straight run of fence shall have at least one ground.
- D. Install ground rod at every point where power line passes over fence; install additional ground rod 100 feet each side of this point.
- E. Install ground rods along fence at 500 ft. maximum intervals when power line parallels and is over or adjacent to fence.
- F. Install 3/4 in. round copper-clad, 10 ft. ground rods 6 in. below top of ground; connect to fence posts with No. 8 AWG bare copper wire and clamp.
- G. Install 3/16 in. by 3/4 in. flexible copper braid jumper from each gate post to each gate leaf and ground each gate post with ground rod.

### 3.04 ADJUSTING

- A. Adjust brace rails and tension rods for rigid installation.
- B. Tighten hardware, fasteners, and accessories.

END OF SECTION

SECTION 03100

CONCRETE FORM WORK

PART 1      G E N E R A L

1.01 SCOPE: This section covers formwork materials, systems, coatings, supports, and accessories for cast-in-place concrete.

1.02 REFERENCE STANDARDS:

- A.            ACI 301 - Specification for Structural Concrete for Buildings.
- B.            ACI 347 - Recommended Practice for Concrete Formwork.

PART 2      P R O D U C T S

2.01 MATERIALS:

- A.    Prefabricated Simplex "Industrial Steel Frame Forms," Symons "Steel Ply," "Universal" "Uniform," or equal.
- B.    Plywood Product Standard PS1, waterproof, resinbonded, exterior type Douglas fir; face adjacent to concrete Grade B or better.
- C.    Fiberboard Fed Spec LLL-B-810, Type IX; tempered, waterproof, screenback, concrete form hardboard.
- D.    Lumber Straight, uniform width and thickness, and free from knots, offsets, holes, dents, and other surface defects.
- E.    Chamfer Strips Clear white pine, surface against concrete planed.
- F.    Bar Supports Product Standard PS7 and CRSI, Class D or E.
- G.    Form Coating Industrial Lubricants "Nox-Crete Form Coating," L & M "Debond," Protex "Pro-Cote," Richmond "Rich Cote," or equal.

2.02 GENERAL REQUIREMENTS

- A.    Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings. Forms shall conform to ACI 347 and the following additional requirements.
- B.    Forms for surfaces which will be exposed to view when construction is completed shall be prefabricated plywood panel forms, job-built plywood forms, or forms

that are lined with plywood or fiberboard. Forms for exposed surfaces shall be laid out in a regular and uniform pattern with the long dimension of panels vertical and all joints aligned. The forms shall produce finished surfaces that are free from offsets, ridges, waves, and concave or convex areas.

- C. Plywood or lined forms will not be required for surfaces which are normally submerged or not ordinarily exposed to view, such as the insides of manholes, basins, and conduits. Other types of forms, such as steel or unlined wooden forms, may be used for surfaces which are not restricted to plywood or lined forms, and may be used as backing for form linings. Forms are required above all extended footings.

### 2.03 DESIGN

- A. The design and engineering of all concrete formwork shall be the responsibility of the Contractor. Forms shall be substantial and sufficiently tight to prevent leakage of mortar. Forms shall be braced or tied to maintain the desired position, shape, and alignment during and after concrete placement. Walers, studs, internal ties, and other form supports shall be sized and spaced so that proper working stresses are not exceeded.
- B. Beams and slabs supported by concrete columns shall be formed so the column forms may be removed without disturbing the supports for the beams or slabs.
- C. Wherever the top of a wall will be exposed to weathering, the forms on at least one side shall not extend above the top of the wall and shall be brought to true line and grade. At other locations forms for concrete which is to be finished to a specified elevation, slope, or contour, shall be brought to a true line and grade, or a wooden guide strip shall be provided at the proper location on the forms so that the top surface can be finished with a screed or template. At horizontal construction joints in walls, the forms on one side shall not extend more than 2 feet above the joint.

### 2.04 FORM TIES

- A. Form ties shall be of the removable end, permanently embedded body type and shall have sufficient strength and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders. Cones shall be provided on the outer ends of each tie and the permanently embedded portion shall be at least one inch back from the concrete face. Permanently embedded portions of form ties which are not provided with threaded ends shall be constructed so that the removable ends are readily broken off without damage to the concrete. The type of form ties used shall be acceptable to the Engineer.
- B. Form ties in exposed surface shall be uniformly spaced and aligned in horizontal and vertical rows.

## 2.05 EDGES AND CORNERS

- A. Chamfer strips shall be placed in forms to bevel all salient edges and corners except the top edges of walls and slabs which are to be tooled and edges which are to be buried. Equipment bases shall have chamfered corners unless specifically shown otherwise on the drawings. Unless otherwise noted, bevels shall be 3/4 inch wide.

## PART 3 EXECUTION

### 3.01 NOTIFICATION

- A. The Contractor shall notify the Engineer at least 48 hours in advance of the times and places he intends to place concrete.

### 3.02 FORM COATING

- A. Use commercial formulation of form oil or form-release agent having proven satisfactory performance. Coating must not bond with, stain, or adversely effect concrete surfaces: It must not impair subsequent treatment of concrete surfaces, including bonding agents, curing compounds and membrane water proofing.

### 3.03 EMBEDMENTS

- A. Anchor bolts, castings, steel shapes, conduit, sleeves, and other materials that are to be embedded in the concrete shall be accurately positioned in the forms and securely anchored. Unless installed in pipe sleeves, anchor bolts shall have sufficient threads to permit a nut to be installed on the concrete side of the form. A second nut shall be installed on the other side of the form and the two nuts shall be adjusted so that the bolt will be held rigidly in proper position.

### 3.04 CLEANING

- A. Temporary openings shall be provided at the bottom of column and wall forms and at other points where necessary to facilitate cleaning and inspection. Embedments shall be clean when installed.

### 3.05 TOLERANCES

- A. Tolerances for formed surfaces shall be as specified in ACI 301 and 347 except as modified herein. In case of conflict between ACI 301 and 347, ACI 347 shall govern. The maximum deviation from a true plane shall not exceed 1/8 inch in 6 feet.

### 3.06 FORM REMOVAL

- A. Forms shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all dead and live loads. Shoring beneath beams or slabs shall be left in place and reinforced as necessary to carry any construction equipment or materials placed thereon. Care shall be taken in form removal to avoid surface gouging, corner or edge breakage, and other damage to the concrete.

### 3.07 REMOVAL STRENGTH

- A. Control Tests: Suitable strength control tests will be used as evidence that concrete has attained specified strength for removal of formwork or shoring supporting weight of concrete in beams, slabs, and other structural members.
  - 1. Field-Cured Test Cylinders: When field-cured test cylinders reach the specified removal strength, formwork or shoring may be removed from the respective concrete placements. Strength data from field-cured test cylinders shall be furnished by the Contractor.
  - 2. Laboratory-Cured Test Cylinders: When concrete has been cured as specified for cast-in-place concrete for the same time period required by laboratory-cured cylinders to reach specified strength, the formwork or shoring may be removed from respective concrete placements. Determine the length of time that the concrete placement has been cured by totaling the number of days or fraction of days, not necessarily consecutive, during which the air temperature surrounding the concrete is above 50° F and the concrete has been damp or thoroughly sealed against evaporation and loss of moisture.
- B. Compressive Strengths: The minimum concrete compressive strengths for removal of all formwork supporting the weight of concrete shall be 75 percent of the specified minimum 28-day strength of the class of concrete involved.

### 3.08 FORM REUSE

- A. The reuse of forms for exposed surfaces will be permitted when thoroughly cleaned and sanded or otherwise dressed so that concrete contact surfaces are restored to original conditions. Forms that are bent, dented or otherwise deformed to the extent that tight joints and tolerance cannot be maintained shall not be used.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1      G E N E R A L

1.01    SCOPE

- A.    This section covers reinforcing steel materials, fabrication and placing for cast-in-place concrete.

1.02    REFERENCE STANDARDS

- A.    Reinforcing steel shall conform to the following standards unless modified in this Section or by the drawings.
  - 1.    American Society for Testing and Materials
    - a.    A 615, "Deformed Billet-Steel Bar for Concrete Reinforcement."
  - 2.    American Concrete Institute
    - a.    ACI 315, "Manual of Standard Practice for Detailing Reinforced Concrete Structures."
    - b.    ACI 318, "Building Code Requirement for Reinforced Concrete."
  - 3.    Concrete Reinforcing Steel Institute
    - a.    CRSI 163, "Recommended Practice for Placing Reinforcing Bars."
    - b.    CRSI 165, "Recommended Practice for Placing Bar Supports, Specifications and Nomenclature."

1.03    SHOP DRAWINGS AND BAR LISTS

- A.    Bar lists and drawings for the placing of reinforcements shall be submitted for review in accordance with the requirements of Section 01300.

1.04    HANDLING AND STORAGE

- A.    Reinforcing steel shall be carefully handled and shall be stored on supports which will keep the steel from contact with the ground.

PART 2      P R O D U C T S

2.01    MATERIALS

A.     Reinforcing Steel

1.     Bars - ASTM A615, Grade 60
2.     Beams Stirrups and Column Ties - ASTM A615, Grade 40. (unless required to be Grade 60 on Drawings)
3.     Column Spirals - ASTM A615, Grade 60.

**PART 3        E X E C U T I O N**

**3.01    R E I N F O R C E M E N T S**

- A.     Reinforcements shall be accurately formed and shall be free from loose rust, scale, and contaminants which reduce bond. Unless otherwise shown on the drawings or specified herein, the details of fabrication shall conform to ACI 315 and 318. Welded wire fabric will NOT be acceptable in lieu of individually placed bars.

**3.02    P L A C E M E N T**

- A.     Reinforcements shall be accurately positioned on supports, spacers, hangers, or other reinforcements and shall be secured in place with wire ties or suitable clips.
- B.     With the exception of contact splices, the clear distance between parallel bars shall be not less than the nominal diameter of the bars, not less than 1.5 times the maximum size of coarse aggregate, and not less than one inch in beams, 1-1/2 inches in columns, or 2 inches in other locations. Where reinforcements in beams are placed in two or more layers, the bars in the upper layer shall be placed directly above the bars in the lower layer.
- C.     Reinforcements shall not be installed for beams or slabs which are supported by concrete columns until after the concrete for the columns has been placed.

**3.03    S P L I C E S**

- A.     Splices shall conform to the details shown on the drawings and with ACI 318 "Building Code Requirements for Reinforced Concrete". Splices at locations other than those shown on the drawings shall be acceptable to the Engineer.
- B.     Except where indicated on the drawings, welding or tack welding of reinforcement is prohibited. Reinforcements upon which unauthorized welding has been done shall be removed and replaced to all applicable requirements.

END OF SECTION



SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1      G E N E R A L

1.01    SCOPE

- A.    The section covers normal weight cast-in-place Portland cement concrete. Forms, concrete joints, and reinforcing are covered in other sections in Division 3. Placement, testing, finishing, grout cleaning, and other appurtenant work specified in this section shall apply to all cast-in-place concrete. **This specification allows for up to 25% fly ash replacement of cement.**

1.02    SUBMITTALS

- A.    Submittals of data and drawings shall be in accordance with the procedure set forth in Section 01300.
  
- B.    The source and quality of concrete materials and the concrete proportions proposed for the work shall be submitted to the Engineer for review before concrete work is started. Certified reports prepared by an independent testing laboratory covering materials and mix design shall be submitted. Review of these reports shall be for general acceptability only and continued compliance with all contract provisions will be required.
  - 1.    Aggregates:    Reports on aggregates shall include the following information:
    - a.    Fine Aggregate
      - 1)    Source and type
      - 2)    Gradation and soundness.
      - 3)    Deleterious substances.
  
    - b.    Coarse Aggregate
      - 1)    Source and type.
      - 2)    Gradation and abrasion loss.
      - 3)    Deleterious substances.
      - 4)    Results of sodium or magnesium sulfate soundness test.
  
  - 2.    Mix Design:    Using concrete materials acceptable to the Engineer, a tentative concrete mix shall be designed and tested for each class of concrete specified, and shall be designed and tested for each size and gradation of aggregates, and for each consistency intended for use on the work. Design quantities and test results of each mix shall be submitted for review.

- a. The report for each tentative concrete mix submitted shall contain the following information:
  - 1) Slump on which design is based.
  - 2) Total gallons of water per cubic yard.
  - 3) Brand, type, composition, and quantity of cement.
  - 4) Specific gravity and gradation of each aggregate.
  - 5) Ratio of fine to total aggregates.
  - 6) Weight (surface dry) of each aggregate per cubic yard.
  - 7) Brand, type, ASTM designation, active chemical ingredients, and quantity of each admixture.
  - 8) Air content.
  - 9) Unit weight.
  - 10) Compressive strength based on 7 day and 28-day compression tests.
  - 11) Drying shrinkage bar tests for each mix design.
  - 12) Time of initial set.
  - 13) Curing Method.

#### 1.03 STORAGE OF MATERIALS

- A. Cement shall be stored in suitable moisture-proof enclosures.
- B. Aggregates shall be stored so that segregation and the inclusion of foreign materials are prevented. The bottom 6 inches of aggregate piles in contact with the ground shall not be used.

#### 1.04 TESTING SERVICES

- A. The tests required in this section shall be performed by a commercial testing laboratory selected and paid by owner in accordance with the requirements of Division 1.

#### 1.05 SERVICE CONDITIONS

- A. Concrete classes shall be defined and used as follows:

<u>Class</u>	<u>Use</u>
A	All concrete unless specifically allowed to be another class.
B	Structural and slab on grade concrete not normally in contact with liquid during plant operation.
C	Paving and sidewalk concrete.

- D            Encasement Concrete - Pipe and electrical conduit encasement, concrete fill, and seal slabs only.

**PART 2      P R O D U C T S**

**2.01    M A T E R I A L S**

**A.      C e m e n t**

- 1.      Class A, B, C and D Concrete, ASTM C150, Type I.
- 2.      All cement used shall be produced at the same plant.

**B.      F i n e   A g g r e g a t e**

- 1.      Clean natural sand, ASTM C33.
- 2.      Artificial or manufactured sand will not be acceptable.

**C.      C o a r s e   A g g r e g a t e**

- 1.      ASTM C33 Crushed rock.
- 2.      Clay and shale particles shall not exceed one percent.

**D.      W a t e r**

- 1.      ASTM C94 Potable.

**E.      W a t e r   R e d u c e r**

- 1.      ASTM C494, Type A, containing no calcium chloride catalyst
- 2.      American Admixtures "Lubricon 400"
- 3.      Master Builders "Pozzolith N"
- 4.      Sika chemical "Plastocrete,"
- 5.      Grace "WRDA/Hycol, WRDA-79, or WRDA-82" or approved equal.

**F.      R e t a r d e r**

- 1.      ASTM C494, Type D

2. American Admixtures "Lubricon R"
  3. Master Builders "Pozzolith R"
  4. Sika Chemical "Plastiment,"
  5. Grace "Daratard 17" or approved equal.
- G. Acclerator
1. ASTM C-444 Type C
  2. Non-chloride type
  3. Grace "Daraset" or equal.
- H. High Range Water Reducer
1. ASTM C494, Type F. (Type G or F/G not approved)
  2. Grade "WRDA-19"
  3. Master Builder's "400 N"
  4. American Admixtures "Melment," or equal.
- I. Air-Entraining Agent
1. ASTM C260
  2. Grace "Daravair-M"
  3. American Admixtures "Amex 210"
  4. Master Builders "MB-VR"
  5. Sika Chemical "AER," or approved equal
- J. Polyethylene Film
1. Product Standard PS17, 6 mil.
- K. Membrane Curing Compound

- 1. Fed Spec TT-C-0800, Type I; minimum 18 percent solids, nonyellowing, and minimum water retention 0.039 gm/cm<sup>2</sup>; ALX-9
- 2. Protex "Acrychlor"
- 3. Sonneborn "Kure-N-Seal," or equal.
- L. Bonding Agent
  - 1. Grace "Daraweld-C," or approved equal.
- M. Fly Ash
  - 1. Maximum 25% fly ash replacement of cement in the mix design.

**2.02 LIMITING REQUIREMENTS**

- A. For each class of concrete each concrete mix shall be designed to attain the minimum compressive strengths listed below and each component of the mix shall be controlled within the limits of Table 1. Coarse aggregate shall be limited to 1" maximum size for pumped concrete mixes.

TABLE 1

CONCRETE CLASS	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
Min compressive strength				
At 7 days, psi	3000	3000	2000	-----
At 28 days, psi	4000	4000	3000	2500
Min flexural strength				
At 7 Days, PSI	-----	-----	450	-----
Max water/cement ratio by weight	0.45	0.45	0.45	0.50
Max slump, inches	4	5	4	6
superplasticized	9	10	8	10
CONCRETE CLASS	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
Max coarse aggregate size, inches	1	1	1-1/2	1-1/2
Entrained air content at point of placement	4±1%	3±1%	3±1%	3±1%
Water Reducer/Retarder	Req'd	Req'd	Req'd	Optnl
Air-entraining	Req'd	Req'd	Req'd	Req'd
Superplasticizer				
(High Range Water Reducer)	Req'd	Optnl	Optnl	Optnl
Accelerator	Optnl	Optnl	Optnl	Optnl

- B. Concrete slump shall be kept as low as possible consistent with proper handling and thorough compaction. Unless otherwise authorized by the Engineer, slump shall not exceed the maximum slump specified in Table 1.

- C. The admixture content, batching method, and time of introduction to the mix shall be in accordance with the manufacturer's recommendations for minimum shrinkage for compliance with these specifications.
- D. No calcium chloride shall be used.
- E. The minimum acceptable compressive strengths as determined by ASTM C39 shall be as specified for each concrete class.

### **PART 3      EXECUTION**

#### **3.01    NOTIFICATION**

- A. The Contractor shall notify the Engineer at least 48 hours in advance of the times and places he intends to place concrete.

#### **3.02    BATCHING AND MIXING**

- A. Concrete shall be furnished by an acceptable ready-mix concrete supplier and shall conform to ASTM C94.
- B. A delivery ticket shall be prepared for each load of ready-mixed concrete. A copy of each ticket shall be handed to the Engineer by the truck operator at the time of delivery. Tickets shall show the quantity delivered, concrete class, the amount of each material in the batch, the outdoor temperature in the shade, the time at which the cement was added, and numerical sequence of the delivery.
- C. No water shall be added to Class A or B concrete at the job site. Any desired increase in slump shall be attained by use of high range water reducer. Adding water to Class A or B concrete at the job site shall be cause for rejection of the load in question.

#### **3.03    PLACEMENT**

- A. The limits of each concrete placement shall be predetermined by the Contractor and shall be acceptable to the Engineer. All concrete within such limits shall be placed in one continuous operation.
- B. Before concrete is placed, forms, reinforcements, water stops, anchor bolts, and embedments shall be rigidly secured in proper position; all dirt, mud, water and debris shall be removed from the space to be occupied by concrete; all surfaces encrusted with dried concrete from previous placement operations shall be cleaned; and the entire installation shall be acceptable to the Engineer.
  - 1. Concrete shall be conveyed to the point of final deposit by methods which will prevent separation or loss of ingredients.

Concrete shall be placed in final position without being moved laterally in the forms more than 5 feet (except where superplasticizer is used).

2. Concrete shall be placed in approximately horizontal layers of proper depth for effective compaction; however, the depth of a layer shall not exceed 24 inches. Each layer of concrete shall be plastic when covered with the following layer and the forms shall be filled at a rate of vertical rise of not less than 2 feet per hour. Vertical construction joints shall be provided as necessary to comply with these requirements.

Concrete shall be placed and compacted in wall or column forms before any reinforcing steel is placed in the system to be supported by such walls or columns. The portion of any wall or column placed monolithically with a floor or roof slab shall not exceed 6 feet of vertical height. Concrete in walls or columns shall settle at least 2 hours before concrete is placed in the structural systems to be supported by such walls or columns. Concrete shall be thoroughly settled when top finished. All laitance, debris, and surplus water shall be removed from concrete surfaces at tops of forms by screeding, scraping, or other effective means. Wherever the top of a wall will be exposed to weathering, the forms shall be overfilled and after the concrete has settled the excess shall be screeded off.

3. During and immediately after placement concrete shall be thoroughly compacted and worked around all reinforcements and embedments and into the corners of the forms. Mechanical vibrators shall be used which will maintain at least 9000 cycles per minute when immersed in the concrete. Each vibrator shall be driven by not smaller than a 1-1/2 hp motor. The number and type of vibrators shall be acceptable to the Engineer.

4. Except as modified herein, cold weather concreting shall comply with ACI 306. The temperature of concrete at the time of mixing shall be not less than that shown in the following table for corresponding outdoor temperature (in shade) existing at the time of placement:

<u>Outdoor Temperature</u>	<u>Concrete Temperature</u>
Below 30° F	70° F
Between 30° and 45° F	60° F
Above 45° F	45° F

Heated concrete shall not be warmer than 80° F when placed.

When freezing temperatures may be expected during the curing period, the concrete shall be maintained at a temperature of at least 50° F for 5 days or 70° F for 3 days after placement. Concrete and adjacent form surfaces shall be kept continuously moist. Sudden cooling of concrete shall not be permitted.

5. Except as modified herein, hot weather concreting shall comply with ACI 305. At air temperatures weather of 90° F or above, concrete shall be kept as cool as possible during placement and curing. The temperature of the concrete when placed in the work shall not exceed 90° F and ice shall be used as required to maintain the temperature at or below 90° F. In order to prevent plastic shrinkage cracking due to rapid evaporation of moisture, no concrete shall be placed when the rate of evaporation, determined by using figure 2.1.5 in ACI 305, equals or exceeds 0.2 pound per square foot per hour.
6. Construction joints for Portland cement concrete not located on the drawings shall be spaced at a maximum of 40-foot intervals for reducing to a minimum the effect of shrinkage in producing cracks. No two abutting sections shall be placed within a period of 72 hours, unless otherwise authorized by the Engineer.
7. The surface of hardened concrete upon which fresh concrete is to be placed shall be rough, clean, and damp. Surface mortar shall be removed to expose the aggregate. The hardened surface shall be cleaned of all foreign substances (including curing compound), washed with clean water, and kept saturated during the 24-hour period preceding placement of fresh concrete.

Coarse aggregate shall be omitted from the first batch or batches of concrete placed on hardened concrete in wall or column forms. This mortar puddle shall cover the hardened area to a depth of at least 2 in.

### 3.04 REPAIRING DEFECTIVE CONCRETE

- A. Defects in formed concrete surfaces shall be repaired within 24 hours of the removal of forms, to the satisfaction of the Engineer, and defective concrete shall be replaced within 48 hours after the adjacent forms have been removed. All concrete which is honeycombed or otherwise defective shall be cut out and removed to sound concrete, with edges square cut to avoid feathering.



- B. Concrete repair work shall conform to Chapter 9 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing of surrounding concrete. Repair work shall be adequately cured.

### 3.05 FINISHING UNFORMED SURFACES

- A. No surface treatment will be required for buried or permanently submerged concrete not forming an integral part of a structure except that required to obtain the surface elevations or contours and surfaces free of laitance. The unformed surfaces of all other concrete shall be screeded and given an initial float finish followed by additional floating, and troweling where required.
- B. Screeding shall provide a concrete surface conforming to the proper elevation and contour with all aggregates completely embedded in mortar. All screeded surfaces shall be free of surface irregularities with a height or depth in excess of 1/4 inch as measured from a 10-foot straightedge.
- C. Screeded surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance with no unnecessary working of the surface.

Initial floating shall be followed by a second floating at the time of initial set. The second floating shall produce a finish of uniform texture and color. Unless additional finishing is specifically required, the completed finish for unformed surfaces shall be the float finish produced by the second floating.

Floating shall be performed with hand floats or suitable mechanical compactor-floats.

- D. Surfaces of exterior slabs and exterior concrete stair treads shall be given a light broom finish providing a non-slip surface. Brooming shall be done after the second floating and at right angles to the normal traffic direction.
- E. Interior floor surfaces which will be exposed after construction is completed, the exposed portion of the top of equipment bases, the top of interior curbs, and other surfaces designated on the drawings shall be steel trowel finished. Trowel finishing will not be required for floors which are normally submerged. Troweling shall produce a dense, smooth, uniform surface free from blemishes and trowel marks.
- F. All surface mortar shall be removed from surfaces which are to be later covered with concrete or mortar topping. The coarse aggregate shall be exposed in all such surfaces to improve bonding.

- G. Unless specified to be beveled, exposed edges of floated or troweled surfaces shall be edged with a tool having 1/4-inch corner radius.
- H. When checked with sludge collecting equipment, each clarifier or chlorine contact basin floor shall not exceed a deviation of one inch from a plane generated by the rotating arms. Basin floors shall be float finished and water cured.

### 3.06 CURING

- A. Concrete shall be protected from loss of moisture for at least 7 days after placement; however, when concrete is being protected from low temperatures, the time period for curing by saturation shall be one day less than the duration of the low temperature protection. Curing of concrete shall be by methods which will keep the concrete surfaces adequately wet during the specified curing period. Concrete for Class A concrete as described under Service Conditions shall be water cured; membrane curing will not be acceptable.
- B. Water saturation of concrete surfaces shall begin as quickly as possible after initial set of the concrete. The rate of water application shall be regulated to provide complete surface coverage with a minimum of runoff. The application of water to walls may be interrupted for grout cleaning only over the areas being cleaned at the time, and the concrete surface shall not be permitted to become dry during such interruption.
- C. Membrane curing compound may be used in lieu of water curing only on Class B and C concrete which will not be covered later with mortar or additional concrete and that required to be water cured above.

Membrane curing compound shall be spray applied at a coverage of not more than 300 square feet per gallon. Unformed surfaces shall be covered with curing compound within 30 minutes after final finishing. If forms are removed before the end of the specified curing period, curing compound shall be immediately applied to the formed surfaces before they dry out.

Curing compound shall be suitably protected against abrasion during the curing period.

### 3.07 FINISHING FORMED SURFACES

- A. After removal of forms, fins, and other surface projections shall be removed with a power grinder to provide a smooth, flush surface. Tie holes and surface irregularities shall be filled with patching mortar and made to match the texture of adjacent concrete.
- B. Formed surfaces that are exposed to view during normal operation of the plant shall receive a rubbed finish. Rubbing shall be performed soon after form removal with Carborundum stone. Concrete shall be wetted and rubbed to a

paste, the paste shall be spread uniformly, striped with a brush and allowed to take a reset after which the surfaces shall be washed with clean water leaving a uniform appearance and texture.

- C. In lieu of rubbing, the contractor may apply a textured structural coating to the concrete if approved by the Engineer. The coating shall be applied in strict conformity with the manufacturer's recommendations. The coating shall be Preston Shield or approved equal.

### 3.08 CONCRETE EMBEDMENT AND ENCASEMENT

- A. Concrete for embedment and encasement shall be Class D concrete and shall be installed where and as indicated on the plans and at such locations where installation conditions require such pipe reinforcement because of unforeseen conditions encountered in the work, as determined by the Engineer.
- B. Embedment and encasement of pipe and electric conduit shall be preceded by the following preliminary steps:
  - 1. All loose material shall be removed from the trench prior to placing concrete. All concrete shall have a continuous contact with undisturbed soil on sides and bottom of trench.
  - 2. A base course of concrete shall be accurately screeded to such grade and elevation that the pipe will be at specified grade when pipe bells are supported on, and in contact with, the top surface of such base course.
  - 3. Each length of pipe shall be rigidly held in alignment and anchored, to prevent flotation, in a manner acceptable to the Engineer.

### 3.09 FIELD CONTROL TESTING

- A. The responsibility for tests required for field quality control shall be as set forth in Division 1.
- B. The frequency hereinafter specified for each field control test is a minimum. If additional field control tests are necessary, in the opinion of the Engineer, all such tests shall be made.
- C. Each 100 tons of fine aggregate and each 200 tons of coarse aggregate shall be sampled and tested in accordance with ASTM D75 and C136.

- D. A slump test shall be made for each 50 cubic yards of concrete. Slump shall be determined in accordance with ASTM C143. When pumping concrete, slump tests shall be made at both ends of the pumping system at the specified intervals and whenever the pumping system is changed.
- E. Class A or B concrete is used, an air content test shall be made from one of the first three batches mixed each day, and from each batch of concrete from which concrete compression test cylinders are made. Air content shall be determined in accordance with ASTM C231. When pumping concrete, air content tests shall be made at the discharge end of the pumping system.
- F. Compression Tests
1. One set of compression test cylinders shall consist of four cylinders. Cylinders shall be made, cured, stored and delivered to the laboratory in accordance with ASTM C31 and tested in accordance with ASTM C39. Two cylinders from each set shall be tested at 7 days and two at 28 days. Compression tests shall be evaluated in accordance with ACI 214 and 318.
  2. Each set of compression test cylinders shall be marked or tagged with the date and time of day the cylinders were made, the location in the work where the concrete represented by the cylinders was placed, the delivery truck or batch number, the air content and the slump.
  3. The quantity of test cylinders shall be made according to the following schedule:
    - a. Class A Concrete: A minimum of two sets of test cylinders shall be made for each 50 cubic yards, or fraction thereof, placed in any twenty-four-hour period. Also, at least one set of cylinders shall be made for each individual portion of a structure poured in a twenty-four-hour period. An individual portion of a structure is defined as any volume of concrete placed monolithically and separated from the remainder of the structure by any joint as given in Section 03 150. Samples shall be distributed so as to indicate the true quality of all concrete represented by the sample.
    - b. Class B Concrete: A minimum of two sets of test cylinders shall be made for each 100 cubic yards, or fraction thereof, placed in any twenty-four-hour period. Also, at least one set of cylinders shall be made for each individual portion of a structure poured in a twenty-four-hour period. An individual portion of a structure is defined as any volume of

concrete placed monolithically and separated from the remainder of the structure by any joint. Samples shall be distributed so as to indicate the true quality of all concrete represented by the sample.

- c. Class C Concrete: Two sets of test cylinders shall be made for each 500 square yards of pavement (or fraction thereof) placed in a twenty-four-hour period.
- d. Class D Concrete: One set of test cylinders shall be made for each pour of Class D concrete involving more than 5 cubic yards. Testing of smaller quantities shall be as directed by the Engineer.

### 3.10 MIX DESIGN TESTING

- A. The responsibility for tests required for review of materials and mix design shall be as set forth in Division 1. Tests to be performed shall not be less than hereinafter specified.
  - 1. Aggregates shall be sampled and tested in accordance with ASTM C33. In addition, the bulk specific gravity of each aggregate shall be determined in accordance with ASTM C127 and ASTM 128.
  - 2. Slump shall be determined in accordance with ASTM C143 and total air content shall be determined in conformity with ASTM C231.
  - 3. Two sets of compression test cylinders, three cylinders per set, shall be made from each proposed concrete mix. One set of three cylinders shall be tested at an age of 7 days and the other set shall be tested at an age of 28 days. Concrete test specimens shall be made, cured, and stored in conformity with ASTM C192 and tested in conformity with ASTM C39.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1      G E N E R A L

1.01    SCOPE

A.    Shop Drawings

1.    Include information necessary for fabrication and erection of component parts of structure.
2.    Indicate location, type, and size of bolts and welds distinguishing between shop and field connections.
3.    Detail splices.

1.02    HANDLING

- A.    Avoid bending and other damage to structural steel members and connection material in handling.
- B.    Store on skids above ground to keep clean and drained.

PART 2      P R O D U C T S

2.01    MATERIALS

- A.    Plates, Bars, and Structural Shapes: ASTM A36, Grade B.
- B.    Structural Pipe: ASTM A53, Type E or S, Grade B; or ASTM A501.
- C.    Structural Tubing: ASTM A500, Grade B.
- D.    Bolts: ASTM A307 or A325, as shown on Drawings.
- E.    Washers: Comply with ASTM requirements for bolts used.
- F.    Filler Metal for Welding:
  1.    Welding electrodes for manual shielded metal arc welding - AWS A5.1 or A5.5.
  2.    Bare electrodes and granular flux used in submerged-arc process - F60 or F70 complying with AWS A5.17.

3. E60S or E70S electrodes used in gas metal-arc process - AWS A5.18.
  4. E60T or E70T electrodes used in flux-corded-arc process - AWA A5.20.
- G. Grout
1. Nonmetallic, premixed, and nonshrink, COE CRD-C621.
  2. Bleed free at 25 sec. flow cone fluidity, COE CRD-621.
  3. Acceptable products:
    - a. "Masterflow 713", Master Builders Co.
    - b. "Supreme Grout", Gifford-Hill and Co.
    - c. "Crystex", L and M Construction Chemicals, Inc.
    - d. "SikaGrout 212", Sika Corporation

## 2.02 PROTECTIVE COATING

- A. Structural Steel, Nongalvanized:
1. Surface preparation: Commercial blast cleaning, SSPC SP6.
  2. Primer:
    - a. Type: Red or brown one coat shop paint, SSPC Paint 13.
    - b. Number of coats: One.
    - c. Dry film thickness: 2.5 mils minimum.
  3. Finish: See Painting, Section 09900.
- B. Structural Steel, Galvanized:
1. Steel: ASTM A123 with minimum coating of 2 oz. per sq ft of zinc.
  2. Bolts, nuts, and washers in steel exposed to weather: ASTM A153, chase threads after galvanizing, galvanize bolts used with galvanized material.
  3. Touch-up coating:
    - a. One coat 1.0 to 1.5 mils dry film thickness, zinc-rich compound.
    - b. Acceptable products:
      - 1) "Galvanox", Subox, Inc.
      - 2) "PPG Zinc Rich (non-Catayzed) 97-671/672", Pittsburgh Paint Company.
      - 3) "Z.R.C.", ZRC Products Company.

4. Finish Coat(s): See Painting, Section 09900.

## 2.03 FABRICATION

- A. Fabricate structural steel in accordance with AISC S326.
- B. Coordinate holes, clips, loose lintels, tie rods, temporary anchors, and attachments with other trades.

## PART 3 EXECUTION

### 3.01 ERECTION

- A. Erect structural steel in accordance with AISC S326.
- B. High Strength Bolts:
  1. High-strength bolted connections: Friction type.
  2. Use high strength bolts with suitable identifying mark placed on top of head before leaving factory.
  3. Use "Turn-of-the-Nut" method to tighten nuts.
  4. Mark bolts that have been completely tightened with identifying symbol.
- C. Welding
  1. Technique, appearance, quality of welds, and methods used in correcting defective work shall comply with AISC S326 and AWS D1.1.
- D. Setting Plates and Column Base Plates
  1. Set leveling plates and similar items solid in specified grout in compliance with manufacturer's recommendations.
- E. Washers and Nuts:
  1. Provide beveled washers where required to match sloping surfaces of connection material.
  2. Upset bolt threads or tack weld nuts to bolts to prevent backing-off of nuts.
- F. Structural steel members having splices not detailed on shop drawings will be rejected.



G. Burning holes in structural steel members is prohibited.

3.02 FIELD QUALITY CONTROL

A. Materials and workmanship shall be subject to inspection in mill, shop, and field.

B. Correction of Defective Welds.

1. Repair weld areas containing defects and make additional tests of repaired areas.
2. If 20 percent or more of welds made by one welder contain defects requiring repair, 100 percent radiographic inspection of welder's work will be required.

END OF SECTION

SECTION 09901

PROTECTIVE COATINGS

PART 1 GENERAL

1.01 SURFACES TO RECEIVE PAINT

- A. Equipment, buildings, machinery, and all metal work not covered elsewhere except stainless steel, aluminum, bronze, brass, copper, lead, electrical conduit in unfinished areas, PVC, fiberglass, or other plastic pipe. Galvanized surfaces are to be coated only when designated.
- B. All exposed and submerged metal piping.
- C. Interior and exterior surfaces of buildings.
- D. All cabinets and woodwork.
- E. Flooring

1.02 PIPE COATINGS

Protective coatings for ductile iron piping are covered under applicable pipe specification.

1.03 EQUIPMENT PRIMED SURFACES

Final field finish painting of manufacturer's primed equipment not to be accomplished until operational testing and approval have been completed.

PART 2 MATERIALS

The paint schedule and painting schedule in table 3.04 and 3.05 of this specification includes the paint and protective coatings, and sealers to be used on this project. The painting schedule in table 3.05 presents the surface types and the manner in which they are to be prepared and coated. The paint schedule in table 3.04 presents various products which meet a particular coating schedule.

PART 3 EXECUTION

3.01 WORKMANSHIP

Employ only skilled workmen to apply paints and finish materials. Apply paints with brush or spray equipment in even and thorough coats, without runs, sags or other blemishes. Allow all coats of paint, regardless of material used, to dry thoroughly before application of succeeding coat, except when manufacturer recommends otherwise. Properly sand painted surfaces between coats of enamel, paint or shellac when applied to any surface with the exception of masonry. Apply paints in accordance with manufacturer's recommendations.

3.02 PREPARATION OF SURFACES

A. Metal Surfaces: Unless otherwise designated, surface preparation shall be in accordance with the following table.

STEEL

TYPE	SPECIFICATION	DESCRIPTION
Solvent Cleaning	SSPC-SP-1	Removal of oil, grease, dirt, soil, salts and contaminant cleaning with a solvent, vapor, alkali, emulsion or steam.
Hand Tool Cleaning	SSPC-SP-2	Removal of loose rust, loose mill scale, and loose paint to degree specified, by hand chipping, scraping, sanding and wire brushing.
Power Tool Cleaning	SSPC-SP-3	Removal of loose rust, loose mill scale, and loose paint to degree specified by power tool chipping, descaling, sanding, wire brushing and grinding.
White Metal Blast	SSPC-SP-5	Removal of all visible rust, mill scale, paint and foreign matter by blast cleaning by wheel or nozzle (Dry or Wet) using sand, grit or shot.
Commercial Blast	SSPC-SP-6	Blast cleaning until at least two thirds of each element of surface area is free of all visible residue.
Brush-off Blast	SSPC-SP-7	Blast cleaning of all except tightly adhering residues of mill scale, and coating, exposing numerous evenly distributed flecks of underlying metal.
Near White Blast	SSPC-SP-10	Blast cleaning nearly to White Metal cleanliness, until at least 95 % of each element of surface area is free of all visible residues.
Power Tool Cleaning to Bare Metal	SSPC-SP-11	Power tool cleaning to produce a bare metal surface and retain or produce a minimum 1.0 mil surface profile. This standard is suitable where a roughened, clean bare metal surface is required but where abrasive blasting is not feasible or permissible.
Surface preparation and cleaning of metals by water jetting prior to recoating	SSPC-SP-12	Pressure wash (2500 psi, minimum) with tri-sodium phosphate solution (4 ounces TSP per gallon of water); clean water wash until surface pH is 7 to 7.5

B. Concrete Surfaces

CONCRETE

Surface Preparation   SSPC –SP-13

The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptably prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.

Acid Clean

Wash concrete to be painted with 15 percent solution of muriatic acid, and then wash clean with fresh water and thoroughly dry all surfaces. "Spot-in" with additional primer all "hot" or "flat" spots which appear on cement surfaces after application of priming coat. If such spots persist after application of finish coat, completely refinish surface.

Power Wash  
Power Tool Clean

Power Wash and Power Tool Clean the surface to remove all form release agents, dust, dirt, curing compounds, oils, greases. Allow the surface to dry a minimum of 24 hours.

3.03       APPLICATION OF PAINT

A.       General

Use one convenient location for storing and mixing of paint materials and keep fire extinguisher available in this area as long as it is used for such purpose. Protect floor of this area, and all other areas where painting is done, with suitable drop cloths; remove oily rags and waste from building at close of day. On completion of painting operations, clean off all paint spots, oil, and stain from all surfaces and leave entire project in perfect condition as far as painting work is concerned. Remove from premises all containers and debris resulting from painting operations.

B.       Weather

1. No coating work shall be done under unfavorable weather conditions unless the work is under cover, well protected, and specific approval from the Engineer is obtained.
2. No coating or painting shall be applied when the surrounding air temperature or the temperature of the surface to be coated is below 50°F or within 5°F of the dew point

or as specified by manufacturer.

C. Colors

Refer to Section 3.06 for color schedule. Apply to Owner for colors on equipment not listed.

D. Samples

Submit for approval samples of paint materials proposed for use in three displays of each kind and color of paint to be applied to metal and masonry. Submit in addition, if required, one-quarter pint of each kind of paint or stain proposed for use. Make panels used for display representative of respective types of surfaces to which several kinds and colors of paint and stain are to be applied in actual work. Do not deliver paint materials to site of work until after respective samples thereof have been approved.

E. Drying Time

Thoroughly dry each coat of paint before succeeding coat is applied. Allow full drying time between coats as specified by manufacturer of particular paint involved.

F. Coverage

As recommended by manufacturer of particular paint involved.

G. Delivery of Paint

Deliver to site in original (unbroken) sealed containers with manufacturer's label attached.

H. Thinners and Solvents

Use only those thinners and solvents specified in paint formulas of paint being used and mix in proportions as recommended by paint manufacturer.

I. Brush Application

1. Brushes

Use first quality hog hair or suitable synthetic bristle brushes. Use of horse hair bristle brushes not permitted. Keep brushes clean and free from accumulation of dried paint or dirt, and when brushes for oil or varnish base paints are not in use, keep them suspended in raw linseed oil bath. Clean brushes with turpentine or mineral spirits before reuse.

2. Application

Apply in uniform thickness consistent with specified coverage and with sufficient cross-brushing to insure filling of surface irregularities. Exercise particular care in painting around rivet heads, bolt heads and nuts, and in corners and other restricted spaces.

3. Roller

Roller application equipment shall comply with SSPC Vol. I Chapter 5.1 Section C. In addition, the contractor shall consult with the coating manufacturer to establish the correct core and nap length to produce as smooth of a surface as possible

J. Spray Application

Apply with adjustable air gun equipped with suitable water trap to remove moisture from compressed air, and with paint pot having hand agitator. Apply with width of spray not less than 12 inches or more than 18 inches, and with suitable pressure for particular type of paint being used. Make frequent checks to insure correct spreading rate and coating, and apply without sags, runs, or "orange peel" effect. Correct all such imperfections. Take special care to cover edges, corners, and rivet heads without bridging over of paint film.

K. Shop-Coated Metal Surfaces

1. Prior to Installation

After delivery to site of work and prior to installation, keep all shop-coated metal work clean and free from corrosion. Where directed, clean and retouch or repaint damaged areas with additional primer.

2. After Installation

After erection or installation of shop-coated metal work, clean and retouch all rust spots, all places where paint has been rubbed or scraped off, and all field rivet and bolt heads and nuts. After previously applied paint has hardened and when surfaces to receive succeeding coats of paint have been perfectly cleaned and dried, apply paint in accordance with Section 3.05 "Painting Schedule". Allow five (5) days for hardening of final coat before placing in water.

L. Machinery and Electrical Equipment

After installation of machinery and electrical equipment, check base coats carefully and retouch all damaged surface areas. Do not paint nameplates, serial number bases, chrome or bronze trim, or any rotating parts. Clean off any excess paint that impairs convenient removal of covers on gauges, instrumentation or other equipment fitted with doors or

covers.

M. Galvanizing

Galvanizing shall conform to the requirements of ASTM Standards A-123, A-120, and A-153, latest edition. Abraded or otherwise damaged surfaces and cut ends of galvanized members shall be touched-up with a single component, non-toxic, zinc rich compound with 95 percent zinc in the dried film, per Section 05120.

Galvanizing is not recommended for use in chemical exposures outside the pH range of 4.0-13.0. Testing of galvanized coated sheet with primers and/or adhesion promoters must be performed prior to applying coatings.

3.04 PAINT SCHEDULE

The following schedule establishes various paints and primers required under this specification. Specific instructions in other detail specifications supercede paint schedule for shop-coated materials and equipment. Substitutions of paints are not allowed unless specifically approved in advance. Include with request for substitution, complete information as to formulation, coverage, application, etc. Do not mix coating systems of different manufacturers.

**PRODUCTS AND VENDERS**

<b>Product</b>	<b>Sherwin Williams</b>	<b>Tnemec</b>	<b>Carboline</b>
Block Filler	Heavy Duty Block Filler 1.01A	Series 27-WB Typoxy	Sanitile 100
Acrylic Polyurethane	Acrolon 218 HS	Series 73 Endura-Shield	Carbothane 134HG
Fast Cure Epoxy	Macropoxy 646	Series 161 Tneme-Fascure	Carboguard 60
Zinc- Rich Coating	Zinc Clad II Plus	Series 90-97 or Series 90-1K97 Tneme-Zinc	Carbozinc 859
Zinc Primer	Corothane I Galvapak Two Pack	Series 90-97 or Series 90-1K97 Tneme-Zinc	Carbozinc 621
Polyamidoamine Epoxy (High Build Epoxy)	MP646, Tile-Clad II HS	Series N69 Hi-Build Epoxoline II	Carboguard 891HS
Exterior Wood Primer	A-100 Latex Wood Primer	Kilz Original	Sanitile 120
Exterior Latex	A-100 Exterior Latex Coating (A6 Series)	Series 6 Tneme-Cryl	Carborylic 3359
Epoxy Primer/Sealer	ArmorSeal 33	Series 201 Epoxoprime	Semstone 110
Self-Leveling Epoxy	ArmorSeal 650 SL-RC	Series 280 Tneme-Glaze	Sanitile 945 SL
Coal Tar Epoxy		Hi-Build Tneme Tar Series 46H-413	Bitumastic 300



3.05 PAINTING SCHEDULE  
Architectural and Structural

A. Exterior

<b>Type of Surface</b>	<b>Preparation</b>	<b>Primer</b>	<b>1<sup>st</sup> Coat</b>	<b>2<sup>nd</sup> Coat</b>
Architectural Metal Work	SSPC-SP6 or SSPC-SP2 & SSPC-SP3	Polyamide Epoxy 4.0 to 6.0 mils	Polyamide Epoxy 4.0 to 6.0 mils	Polyurethane 2.0 to 5.0 mils
Structural Steel and Misc. Steel	SSPC-SP-6	Zinc Rich Primer 2.5 to 4.0 mils	Polyamide Epoxy 4.0 to 6.0 mils	Polyurethane 2.0 to 5.0 mils
Concrete Block /Precoat Building	Power – Wash & Power Tool Clean	Block Filler 2 Coats 10 to 18 mils	Polyurethane 3.0 to 6.0 mils	Polyurethane 3.0 to 6.0 mils
Wood	Sand	Latex Wood Primer 2.0 to 3.0 mils	Exterior Latex 2.0 to 3.0 mils	Exterior Latex 2.0 to 3.0 mils
Ductile Iron Piping	SSCP-SP -1	Zinc Primer	Acrylic Polyurethane 3.0 to 5.0 mils	Total film thickness 9.0 mils

B. Interior

<b>Type of Surface</b>	<b>Preparation</b>	<b>Primer</b>	<b>1<sup>st</sup> Coat</b>	<b>2<sup>nd</sup> Coat</b>
Architectural Metal Work	SSPC-SP6 & SSPC-SP2 & SSPC-SP3	Polyamide Epoxy 4.0 to 6.0 dry mils	Polyamide Epoxy 4.0 to 6.0 dry mils	Acrylic Polyurethane 4.0 to 6.0 mils
Structural Steel & Misc. Steel	SSPC-SP-6	Zinc Primer 1 coat 2.5 mils	Polyamide Epoxy 4.0 to 6.0 dry mils	Acrylic Polyurethane 4.0 to 6.0 dry mils
Concrete Block /Precoat Building	Power-Wash & Hand Tool Clean	Block Filler 10-18 dry mils (1 or 2 coats as needed)	Exterior Latex Coating 2.0 to 3.0 mils	Exterior Latex Coating 2.0 to 3.0 mils
Concrete floors	Acid Clean 15% Muratic acid solution	Epoxy Primer/Sealer 6.0 to 8.0 mils	Self-Leveling Epoxy ( may add aggregate, allow to dry before removing excess	Self Leveling Epoxy 6-8 mils

C. Submerged Metal/Piping, and Mechanical

<b>Type of Surface</b>	<b>Preparation</b>	<b>Primer</b>	<b>1<sup>st</sup> Coat</b>	<b>2<sup>nd</sup> Coat</b>
Submerged metal and piping	SSPC-SP10 or SSPC-SP6 per manufacturer		Coal Tar Epoxy 10 mils	Coal Tar Epoxy 10 mils
Shop Primed metal work	SSPC-SP6	Epoxy Primer 4-8 mils	Epoxy 3-6 mils	High Solids Polyurethane 2-4 mils
Exterior Exposure Machinery Pumps	SSCP-SP-3	Epoxy Primer 4-8 mils	Epoxy 3-6 mils	High Solids Polyurethane 2-4 mils
Interior Machinery, Pumps	SSCP-SP-3	Epoxy 4-10 mils	High solids Polyurethane 2-4 mils	N/A

3.06 COLOR SCHEDULE

In an effort to standardize colors of equipment and comply with TCEQ requirements [30 TAC 217.329 and 30 TAC 290.42(d) (13)], the following colors will be used on the equipment indicated.

Doors and Hatches	Gray
Structural Steel	Gray
Pumps, Motors, Machinery	Gray
Exposed Lines, Valve Boxes	Gray
Valve Operators	Blue
Ladder Handrails, Guardrails	Safety Yellow
Fire Hydrants, Fire Exit Signs, Fire Pump	Red
Chain Guards, Belt Guards, Gear Guards	Safety Orange
Compressed Air Lines	Light Green
Chlorine	Safety Yellow
Sulfur Dioxide	Lime Green with Yellow bands
Potable Water	Light Blue
Sludge	Brown
Nonpotable Water	Purple

3.07 INSPECTION

During and after final application of protective coatings, all metal surfaces shall be checked mechanically with an Elcometer, Mikrotest or other approved dry film thickness gauge to insure that the specified dry film thickness has been attained. All submerged or intermittently submerged metal surfaces and metal in areas subject to severe chemical attack shall be electrically tested for film continuity by means of an approved low voltage flaw detector such as Tinker & Rasor's M-1 or K-D's "Bird Dog." The inspection described in this paragraph shall be conducted by a laboratory designated by the Engineer and the cost included in price of the work.

END OF SECTION

SECTION - 11205  
HYPOCHLORINATION EQUIPMENT

PART 1 GENERAL

1. SECTION INCLUDES:

- A. Furnish, install, test, and place in satisfactory operation all of the liquid sodium hypochlorite (chlorine bleach) feeding equipment and accessories, all as indicated and specified.
- B. Coordination: Coordinate with electrical Work as specified in Division 16.

2. SYSTEM DESIGN

- A. General: Furnish and install a liquid sodium hypochlorite metering system that will be energized each time the water well comes on, resulting in accurate dosing for disinfection of the raw well water.

3. QUALITY ASSURANCE

- A. All materials and products that come into contact with potable water will conform to ANSI/NSF Standard 61.
- B. Equipment of manufacturer's latest and proven design, compatible with functions required.
- C. Components furnished to manufacturer's standard for sodium hypochlorite service.

4. SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01300 at appropriate time.

PART 2 PRODUCTS

1. PERISTALTIC METERING PUMP

- A. Provide two (2) positive displacement, peristaltic metering pumps, designed for installation on a horizontal surface as shown on the Drawings. Install pump on a non-corrosive wall bracket. Provide one replacement pump tube for each pump furnished.
- B. Pumps shall be Stenner Model 45MHP10 or approved equal and shall operate on 120 volt, 1 phase, 60 Hz electrical power.
- C. Pumps shall have a minimum capacity of 10.0 gallons per day at a discharge pressure of 100 psi.

- D. Pumps shall have a manually variable speed knob adjustable from 5% to 100% of full stroke length.
- E. Pumps shall come with suction and discharge tubing and fittings and foot valve/strainer.

## 2.02 STORAGE FACILITIES

- A. Bleach Storage Tank - High Density Polyethylene, 1.9 S.G., 30 gallon chemtainer or approved equal.

## 2.03 PIPING, VALVES AND ACCESSORIES

- A. Pipe Materials - provide schedule 80 PVC piping and fittings, rated for a minimum pressure of 400 PSIG at 73 degrees F.
- B. Joints - as far as practicable, all joints to be solvent weld socket type. Where threaded joints are necessary to transition to equipment, joints to be made using Teflon tape jointing material.
- C. Ball Valves - Chemtrol Tru-union PVC Ball Valves, Viton fitted.
- D. Ball Check Valves - Chemtrol Tru-union PVC Ball Check Valves, Viton fitted.
- E. Pipe Clamps - Nonmetallic type designed to conform to the shape of the pipe, Duraplus Cobra pipe clips or approved equal.

## PART 3 EXECUTION

### 1. INSTALLATION AND TESTING

- A. Install all equipment and connecting piping in accordance with manufacturer's instructions. Prior to testing and start-up, inspect to verify the system is complete.
- B. No form of energy shall be turned on to any part of the system prior to approval of factory authorized service representative.
- C. Clean all new piping prior to testing.
- D. After installation, and in the presence of the Engineer, test all pipelines for tightness in acceptable manner. Furnish suitable testing plugs or caps, all necessary pipe connections, test fluids, gauges or other equipment and all labor required.
- E. Remove or valve off from lines all instrumentation and appurtenant equipment which is not capable of withstanding the test pressures.
- F. After installation of equipment in the presence of the Engineer, operate each unit to demonstrate its ability to operate without leakage and to perform its specified functions satisfactorily.

END OF SECTION

SECTION 11315

WATER BOOSTER PUMPS

PART 1      G E N E R A L

1.01    DESCRIPTION

- A.      Furnish and install vertical, end suction centrifugal pumps to take suction from the ground storage tank and to deliver pressurized water to the potable water supply system and hydropneumatic tank.
- B.      Provide two (2) pumping units as specified.

1.02    QUALITY ASSURANCE

- A.      System Coordination: Contract Documents describe details of complete equipment installation for purpose specified. CONTRACTOR is responsible for all details necessary to properly install, adjust, and place in operation a working system.
- B.      Warrant units to be free from defects for a period of 12 months from initial start-up (substantially complete). Any repairs or adjustments required within the warranty period shall be furnished without labor or material cost to the Owner.

1.03    SUBMITTALS

- A.      Shop Drawings: Furnish the following in accordance with Section 01300.
  - 1.      Pump performance curve showing capacity in gpm versus total dynamic head (TDH), brake horsepower required, operating speed, and wire-to-water efficiency. Curve to be complete from shut-off to minimum TDH.
  - 2.      Motor design data and rating, including full load amps and kW input at rating point.
  - 3.      Dimensioned installation drawings.
- B.      Operation and Maintenance Manuals - Furnish in accordance with Section 01300.
  - 1.      Assembly, installation, alignment, adjustment, and checking instructions.
  - 2.      Lubrication and maintenance instructions.
  - 3.      Guide to "Troubleshooting".
  - 4.      Parts lists.

**PART 2      P R O D U C T S**

**2.01    PUMPING UNIT - CONSTRUCTION AND MATERIALS**

- A.    Lead Ban: The use of pipes, pipe fittings, plumbing fittings and fixtures that contain more than 0.25 percent lead is prohibited.
- B.    Casing and Impeller: Cast iron.
- C.    Close coupled design
- D.    Shaft Seal: Mechanical type
- E.    Motor Bearings: Sealed
- F.    Motor: Close-coupled with motor extending into pump shaft.

**2.02    PUMP DESIGN**

<u>Parameter</u>	<u>Booster</u>
Service Type	
Number of Units	2
Required Total Dynamic Head (TDH), ft.	132
Capacity at required TDH, gpm	150
Pump operating speed at rated head, rpm	3600
Operating head range, ft.	112 to 157
Maximum brake horsepower required at input shaft for any point in operating head range	6.73
Minimum pump efficiency at rated head, percent	74.1
Inlet Connection, in.	3
Discharge Connection, in.	2
Electrical characteristics:	
Current Phase	3
VAC	460
Hz.	60
Motor HP. required	7.5
Acceptable Model Griswold	R2GM

**PART 3      E X E C U T I O N**

**3.01    INSTALLATION**

- A.    Installation by qualified technician in the location shown on the Drawings.

**3.02    FIELD QUALITY CONTROL**

- A.    Test pumps at start-up; record voltage, current, and other significant parameters.

END OF SECTION

SECTION 13200

WATER WELL AND PUMPING EQUIPMENT

PART 1      G E N E R A L

1.01    DESCRIPTION: This section covers furnishing all labor and equipment for drilling, casing, cementing, screening, developing, testing and disinfection of one water well and the furnishing of pumping, piping, storage, control and appurtenant equipment.

1.02    LOCATION: The water well will be constructed at 32225 US HWY 90 Business, Brookshire, Texas 77423.

1.03    QUALITY STANDARDS

- A.      ANSI - American National Standards Institute
- B.      AWWA - American Water Works Association
- C.      EPA - United States Environmental Protection Agency
- D.      NEC - National Electrical Code
- E.      NSFI - NSF International
- F.      TCEQ - Texas Commission on Environmental Quality

1.04    SUBMITTALS

A.      Submittal Drawings:

- 1.      Submit well pump and well screen data indicating compliance with equipment specifications prior to placing equipment in the well. It is acceptable to have the supplier to fax information directly to Engineer's office.

B.      Tests and Certifications To Be Furnished By Drilling Contractor

- 1.      Well pumping test (36 hours or shorter as allowed by TCEQ Rules).
- 2.      Bacteriological testing of three samples of raw, unchlorinated water, as required by TCEQ, performed by a TCEQ Accredited Laboratory.
- 3.      Laboratory report on chemical analysis to be taken after the well pumping test as required by TCEQ, performed by a TCEQ Accredited Laboratory.
- 4.      State of Texas Water Well Report, including Driller's Well Log.
- 5.      Provide a completed TCEQ Cementing Certificate for PWS Groundwater Well Construction form (attached).
- 6.      Radionuclide water analysis performed by a TCEQ Accredited Laboratory.
- 7.      **Optional at Owner's Direction.** Results from electric resistivity and gamma ray logs.



C. Operation and Maintenance Manuals: Three copies of an Operation and Maintenance Manual for the well, booster pumps, tanks, and controls, including performance data on the well pump and motor, the driller’s well log, well water chemical test data, bacteriological test data, radionuclide test data, well production test data, product literature on the screen, tank literature, valve literature and any other useful information related to construction of the well.

1.05 Wells constructed under this specification shall meet the requirements of all TCEQ regulations, including 30 TAC §290.41(c) - “Groundwater Sources and Development” and “AWWA Standard A100 - Water Wells”, or the latest edition thereof. Should the contractor note any discrepancies between these standards and the engineering drawings and technical specifications, he shall immediately make such conflicts known to the Engineer.

1.06 WELL NO. 1 DESIGN REQUIREMENTS: The well is to be constructed and installed according to the following criteria:

	<u>Base Bid</u>
Test Hole Depth, Feet (See Note 1)	300
Minimum Borehole Diameter, Inches	8.75
Well Casing Pipe Inside Diameter, Inches	4.91
Well Casing Pipe Outside Diameter, Inches	5.563
Well Casing Pipe Material	SDR 17 PVC
Maximum Diameter of Pump or Motor, Inches	3.97
AWWA Cementing Grouting and Sealing Method, Section	C.4
Depth to Bottom of Well Casing, Feet (Estimate)	270
Depth to Bottom of Well Screen, Feet (Estimate)	290
Minimum Diameter Size of Screen, Inches	3.0
Minimum Diameter of Blank Liner, Inches	3.0
Length of Blank Liner, Feet (Including Ext. Inside Casing)	10
Minimum Length of Screen, Feet	20
Pump Setting, Feet Below Grade	260
Pump Discharge Column Pipe Size, Inches	2.067
Column Pipe Material	SCH 40 Galv Stl
Static Water Level, Feet Below Grade	80
Target Specific Capacity (gpm/ft. drawdown)	0.8
Pumping Level, Feet Below Grade	170
Production Capacity (240 Feet, TDH), gpm	48

Note 1: Contractor must cement plug test hole to the bottom of the lowest producing aquifer.

**PART 2      P R O D U C T S**

2.01 All products and materials that come into contact with potable water must conform to ANSI/NSF Standard 61

2.02 The premises, materials, tools and drilling equipment shall be maintained so as to minimize contamination of the underground water during drilling operations.

A. Water used in any drilling operation shall be of safe sanitary quality. Water used in the mixing of drilling fluids or mud shall contain a chlorine residual of at least 0.5 mg/L.

- B. A mud drilling pit will be permitted if all liquids and cuttings are removed from the site after completion of well and the pit is filled back in with compacted soil, equal in quality to the soil which was removed.
  - a. Clean all drill bits, drill stem, drilling tools, piping, fittings, etc. prior to inserting them into the drill hole. Keep drill stem and other drilling equipment on a trailer or rack; do not lay directly on the ground. Drilling personnel shall be encouraged to frequently wash and disinfect their hands to prevent contamination out of the drill hole.
  - b. No temporary toilet facilities shall be maintained within 150 feet of the well being constructed unless they are of a sealed, leak-proof type.
  
- 2.03 Lead Ban: The use of pipes, pipe fittings, plumbing fittings and fixtures that contain more than 0.25 percent lead is prohibited:
  
- 2.04 Well Screen: The portion of the well below the well casing shall be stainless steel rod base screen in the length specified above if adequate water producing sands are available. The entrance velocity into the screen shall not exceed a velocity of 0.1 ft/sec without approval of the Engineer.
  
- 2.05 Casing: All casing shall be SDR 17 PVC and conform to AWWA standards.
  
- 2.06 Blank Liner Pipe: Blank liner pipe shall be Schedule 80 PVC and conform to AWWA standards.
  
- 2.07 Column Pipe: Column pipe shall be Schedule 40 galvanized steel pipe with screw coupled joints.
  
- 2.08 Casing Seal: Sanitary well seal with gooseneck vent, 16 mesh stainless steel screen, relief valve and sampling tap.
  
- 2.09 Static Level Tubing: Provide 3/8-inch polyethylene tubing wire-tied to the column pipe from the top of the well to the top of the well pump intake to be used for in measuring the static and pumping levels in the well. Mount gauge assembly at wellhead to that it is relatively easy to determine the water level inside the casing.
  
- 2.10 Meter: Furnish and install an AWWA approved meter of the size of the well discharge piping with a maximum capacity of at least 50% greater than the stated minimum well production capacity above. The meter shall be installed with the manufacturer's recommended distance of straight, unobstructed pipe upstream and downstream of the meter.
  
- 2.11 Well Pumps furnished are to be equal to the following:
  - A. Well Pump No. 1
    - Model - Grundfos Model 60S50-9, or approved equal
    - Discharge - 2.0-inch NPT
    - Motor - 5 HP, 230 volt, 1 ph., 60 Hz.
    - Capacity - 48 gpm @ 240 feet TDH
  
- 2.12 Well Starters and Control Panel: Provide Franklin Motor Protective Well Control Panel, Subtrol Equipped (or approved equal), with elapsed time meter in NEMA 4X SS Enclosure.
  
- 2.13 Electrical Cable: Double jacked 3 wire of the size recommended by the manufacturer with ground cable from wellhead junction box to well motor. Electrical wiring and components shall be grounded in accordance with NEC.

**PART 3      EXECUTION**

- 3.01 All driller operations shall be in full compliance with the latest rules of the State of Texas that relate to the drilling of public water wells in accordance with 30 TAC 290.
- 3.02 The driller shall initially drill a test hole to the required depth and shall maintain an accurate driller's well log. The driller's log shall be submitted to Engineer along with a sample of the sand formation extracted from the well in the zone(s) that driller intends to screen. No further work on the site shall be begun until Engineer approves the proposed screen setting depth and type of screen to be used.
- 3.03 **Optional at OWNER's direction. When pilot or test hole has been drilled to the depth indicated in Part 1 or an alternate depth selected by the Engineer, a combination electric resistivity log with a gamma ray log shall be made in the pilot or test hole. When the required depth is reached, circulation shall continue until all drill cuttings have been removed from the hole and the drilling fluid in the hole is uniform. Only after the logging service equipment is on location shall the drill pipe be removed from the total depth of the well. The electric and gamma ray logs shall be made immediately following the removal of the drill pipe from the pilot or test hole.**
- 3.04 Contact Engineer (D. Ray Young, P.E. - 281-373-0500 (phone) or 281-373-1113 (fax)) at least 48 hours before beginning drilling operations and at least 48 hours before beginning to set casing and cementing the casing. **Engineer shall be notified two hours prior to casing being set to allow Engineer to be present at the site when the casing is placed into the borehole and the cementing operation is begun.**
- 3.05 All chemicals used in the treatment of water supplied by public water systems must conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 60 for direct additives and ASI/NSF Standard 61 for indirect additives. Conformance with these standards must be obtained by certification of the product by an organization accredited by ANSI (290.42(i)).
- 3.06 Containment facilities for a single container or for multiple interconnected containers must be large enough to hold the maximum amount of chemical that can be stored with a minimum freeboard of six vertical inches or to hold 110% of the total volume for the containers whichever is less (290.42(d)(6)(E)(ii)(I)).
- 3.07 Concrete Sealing Slab Reinforcement: The concrete sealing slab reinforcement shall consist of #5 bars at 12-inch centers each way each face. **Wire mesh reinforcement shall not be used.**
- 3.08 Well Casing Installation: Well hole diameter shall be sized for installation of the well casing pipe with adequate annular space between the outside of the pipe wall and the drilled hole for cementing (minimum 1-1/2 inches each side of pipe wall).
- 3.09 Well Casing Cementing: The neat cement grout mixture shall comply with section 4.3.5, AWWA Standard A100, which allows a maximum of 6 gallons of water per 94 pound sack of cement weighing approximately 118 lb. /cu. ft. A bentonite mixture up to 6%, by weight, is allowed at the driller's discretion as noted in the intervals outlined in the table below.

Percent Bentonite	Max Water Requirements		Slurry Weight		Slurry Volume Cu.Ft./Sk.
	Gal./Sack	Cu.Ft./Sk.	Lbs./Gal.	Lbs./Cu.Ft.	
0	5.2	0.70	15.6	117	1.18
2	6.5	0.87	14.7	110	1.36
4	7.8	1.04	14.1	105	1.55
6	9.1	1.22	13.5	101	1.73

A maximum 6 percent, by weight, bentonite and 2 percent, by weight, calcium chloride may be added. The cement shall be allowed to set for not less than 24 hours before drilling the cement plug.

- 3.10 Protection of the Well: Following completion of the well and prior to installation of the permanent pumping equipment, the well shall be protected from contamination or damage.
- 3.11 Well Disinfection: Upon well completion, the well shall be disinfected in accordance with current AWWA C654 standards for well disinfection except that the disinfection shall remain in the well for at least six hours. Before placing the well in service, the water containing the disinfectant shall be flushed from the well and then samples of water collected and submitted for microbiological analysis until three successive daily raw water samples are free of coliform organisms. The analysis of these samples must be performed by a TCEQ Accredited Laboratory.
- 3.12 Production Test: The Contractor shall perform a production test when the well is completed in accordance with TCEQ regulations. The test report shall include data on well output and well pumping level over the 36 hour period. The production test may not be shortened. Well tests must be recorded on Engineer's forms, signed and submitted to the Engineer. If test data is submitted without accurate pumping level and water meter reading data, the Engineer will require that the production test be rerun. **Engineer shall be notified two hours prior to the start of the 36-hour pump test and two hours prior to the completion of the 36-hour pump test.**
- 3.13 Bacteriological Analysis Report: After completion of the well pumping test with the specified pump in place, collect samples of the raw well water and submit them to a TCEQ Accredited Laboratory for analysis of coliform bacteria. Well must be free of coliform bacteria on three successive days.
- 3.14 Chemical Analysis Report: After completion of the well pumping test with the specified pump in place, collect a sample of the well water and submit it to a TCEQ Accredited Laboratory for analysis for the following constituents according the TCEQ requirements as set forth in §290.101 and §290.105. **Note: pH and temperature to be recorded onsite by accredited lab.**

Arsenic	Barium	Beryllium	Chromium	Nickel	Selenium
Aluminum	Copper	Iron	Manganese	Silver	Zinc
Sulfate	Chloride	Fluoride	pH	Nitrate	Nitrite
Sodium	TDS	Lead	Alkalinity as CaCO3	Calcium as CaCO3	

- 3.15 Radionuclide Analysis Report: After completion of the well pumping test with the specified pump in place, collect a sample of the well water and submit it to a TCEQ Accredited Laboratory for analysis for the following constituents according the TCEQ requirements.

Gross alpha	Radium - 226/228	Beta particle	Uranium
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- 3.16 Records: The Contractor shall furnish the Owner with a written log of the well showing the formations encountered, the thickness, the location of material setting, the static level, the pumping level and other necessary information to complete the records of the well. Such records shall include Bacteriological, Chemical, and Radionuclide test reports as required above from the completed well. The Contractor shall satisfy all requirements of the TCEQ pertaining to submitting of data and samples for public water supply wells.
- 3.17 Warranty: The complete system shall be guaranteed for a period of twelve months from the date of acceptance by Owner.

END OF SECTION

# TCEQ Cementing Certificate for PWS Groundwater Well Construction

PWS Nº : \_\_\_\_\_ TCEQ Approval Letter Log Nº: P-\_\_\_\_\_

Cementing Company Name

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Name and Title of Company Representative \_\_\_\_\_ Telephone Number \_\_\_\_\_

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Company Address

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### Cementing Information

AWWA A100-15 Appendix C Method Used for Cementing Well* (circle method used)	C2	C3	C4	C5
Casing Material and Specification (AWWA A100-15 Table 2 "Water well casing materials")	Check the appropriate pipe on following sheet			

Note: Please use columns 2-3 only if increasing or decreasing borehole and/or casing sizes are utilized

Information	Size 1	Size 2	Size 3
Borehole size (inch)			
Actual Casing size (inch of outside diameter)			
Ground Surface Elevation (GSE) as (msl or 0)			
Top of casing elevation (msl or +GSE)			
Bottom of casing elevation (msl or -GSE)			
Number of centralizers used			
Vol. - sacks of cement (with water & additives)			
Vol. of hole (annular space) to be cemented**			
Number of sacks calculated to fill annular space			
Number of sacks of 94 lb. cement used			
Volume balance between sacks used & required			
Gallons of water used per 94 lb. sack of cement and additives			
Depth of pressure cementing			
Date of pressure cementing			
API Class of cement used			
Additives used (bentonite, calcium chloride, etc)			
% of additive added to cement -			
% of additive added to cement -			
% of additive added to cement -			

\*Please note that AWWA A100-15 Method C1 is not allowed to be used, see 30 TAC §290.41(c)(3)(C)

\*\*borehole minus outside diameter of casing pipe

Signature of Representative

Date

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American Water Works Association Standard  
A100-15 Water Wells

APPENDIX C  
Grouting and Sealing—Methods of Placement

**SECTION C.2: Positive Displacement – Exterior Method**

**SECTION C.3: Interior Method – Without Plug**

**SECTION C.4: Positive Placement, Interior Method – Drillable Plug**

**SECTION C.5: Placement through Float Shoe Attached to Bottom of Casing**

*\* For details of these approved methods refer to AWWA A100-15 Appendix C for details.*

**Water-well Casing Materials Table 2 from AWWA A100-15**

A. Manufacturing standards for single-ply carbon-steel well casing:

- ANSI/AWWA C200
- API Spec. 5L
- ASTM A53 Grade B
- ASTM A139 Grade B

B. Manufacturing standards for alternative-ply well-casing materials:

- |  |  |
|--|--|
| <input type="checkbox"/> Casing Material               | Manufacturing Standard   |
| <input type="checkbox"/> Carbon Steel                  | ASTM A139 Grade B  |
| <input type="checkbox"/> Copper-Bearing Steel          | ASTM A139 Grade B with additional requirement that the steel contain a minimum of 0.20% copper |
| <input type="checkbox"/> High-Strength Low-Alloy Steel | ASTM A606 Type 4   |
| <input type="checkbox"/> Stainless Steel               | ASTM A778  |
| <input type="checkbox"/> Plastic                       | ASTM F480  |







TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

PTR SECTION STAFF GUIDANCE

**PUMPING TEST FOR PUBLIC WATER WELLS**

**Rule Affected:** Title 30 Texas Administrative Code (30 TAC) §290.41(c)(3)(G)

**Background:**

30 TAC §290.41(c)(3)(G) of our current **Rules and Regulations for Public Water Systems** states that a 36-hour pump test is required as part of the completion data for a public water well.

**Guidance:**

To reduce water usage, shorter periods can be accepted under the following conditions:

**New Wells**

1. The pumping rate remains constant for at least four hours, and the pumping period has been a minimum of 24 hours, **or**
2. The pumping rate remains constant for at least four hours, and a straight-line trend is observed on a plot of water level versus a logarithm of time during pumping and recovery.

**As-Built Wells and Emergency Use of Wells for Public Water Systems**

1. As built wells with documentation of a drill date prior to September 1, 2000 responding to an "As Built" plan notice of violation may submit 18 months of daily usage data to establish the well capacity rating. The rating will be based on the maximum daily pumpage. PWSs with less than 250 connections may submit weekly pumpage data and request a calculated rating based on weekly data.

Well performance testing results must be submitted with well completion data. The pump test procedure must comply with Section 5.1 of American Water Works Association standard A100-06. A minimum of a four-hour resting period is required between prior pumping and the test itself.

Finalized and Approved by:



*Vera Poe, P.E., Acting Section Manager, 10/20/2014*

If no formal expiration date has been established for this staff guidance, it will remain in effect until superseded or canceled.

SECTION 13203

FIBERGLASS GROUND STORAGE TANKS

PART I GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass ground storage tank, complete with accessories as specified and shown on the Drawings, to be furnished and erected on Owner's site. Tank shall be used for the storage of chlorinated ground water.

1.02 REFERENCES

- A. AWWA D120 – Fiberglass Reinforced Plastic.
- B. ASTM D3299 – Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks
- C. NSF 61 - Standard for tank disinfection
- D. TCEQ RG-195 - Rules and Regulations for Public Water Systems

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Tank manufacturer shall be a specialist in the design and fabrication of fiberglass ground storage tanks. The manufacturer shall be quality certified, having an active API-Q1 certification.

1.04 DESIGN CRITERIA

Product	Chlorinated Ground Water
pH	6 to 9
Temperature	Ambient (33 to 100 degrees Fahrenheit)
Nominal Capacity	4,512 gallons
Diameter	8 ft. 0 inches
Height	12 ft. 0 inches
Roof Deck Slope	1-inch vertical drop per 12 inches horizontal
Deck Live Load	15 PSF
Wind Speed	100 miles per hour (when completely erected)

1.05 OPERATION AND MAINTENANCE DATA

Submit operation and maintenance data as requested.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Tank Structure: The materials, design fabrication and erection of the fiberglass tank shall conform to the AWWA D120.
  - a. Fiberglass
    - i. Minimum Wall Thickness – 0.375 inches
  - b. Bolts
    - i. Equal to 304 Stainless Steel
- B. Coating: ANSI/NSF Standard 61 approved white epoxy liner, field coating except for touch-up will not be permitted.

**2.02 ACCEPTABLE MANUFACTURERS**

- A. The steel tank and accessories furnished under this section shall be manufactured by one of the following:
  - 1. L.F. Manufacturing, Inc., Giddings, Texas
  - 2. Nationwide Tank and Pipe, LLC, New Braunfels, Texas

**2.03 ACCESSORIES**

- A. The Contractor shall furnish and install the appurtenances as shown on the Drawings, specified herein and/or as required by the TCEQ Chapter 290 Rules and Regulations for Public Water Systems, revised January 2019.
  - 1. Inlet Connections: Provide one 2-inch threaded flange in the location shown on the Drawings.
  - 2. Outlet Connection: Provide one 4-inch threaded flange outlet with interior in the location shown on the Drawings.
  - 3. Overflow: Provide one 3-inch overflow connection in the location shown on the Drawings
  - 4. Drain: Provide one 2-inch drain connection in the location shown on the Drawings.
  - 5. Vent: See detail on engineering drawings. Screen material to be corrosion resistant and to be 16-mesh or finer.
  - 6. Tank bottom: the tank shall have a fiberglass bottom.

7. Recirculation, Pressure Sensing, Level Gauge and Sample Tap: Provide two 1-inch threaded half couplings in the locations shown on the Drawings.
8. Outside Tank Ladder: An outside OSHA compliant ladder with lockable security cover shall be furnished at the location designated on the Drawings.
9. Cleanout Manway: Provide one 30-inch ISO cleanout manway in the location shown in the Drawings
10. Access Manway: Provide one 30-inch ISO access manway at top in the location shown in the Drawings with raised curbing at least 4 inches in height, blinds, hinges, and hasp for locking on cover that overlaps curbing at least 2-inches in a downward direction.

### **PART 3 EXECUTION**

#### **3.01 FACTORY COATING**

- A. Interior Coating- ANSI/NSF standard 61 approved white epoxy.

#### **3.02 TESTING**

- A. Following completion of erection and cleaning of the tank, the tank shall be tested for liquid-tightness by filling the tank to its overflow elevation.
- B. Any leaks disclosed by this tank test shall be corrected by the Contractor in accordance with the tank manufacturer's recommendations.
- C. Clean water required for testing shall be furnished by Owner without charge at the time of erection completion. Filling the tank is the responsibility of the Contractor.

#### **3.03 DISINFECTION**

- A. Disinfection must be performed in accordance with AWWA requirements and water samples must be submitted to a laboratory approved by the Texas Department of Health. The sample results must indicate that the facility is free of microbiological contamination before it is placed into service.
- B. Fill the tank with a 50 mg/l chlorine solution made using potable water. Allow the solution to remain in the tank for 24 hours, then flush and refill with potable water and monitor. When the residual in the tank is reduced to 1-2 mg/l total residual chlorine, the sampling and testing of samples for bacteriological contamination may begin.

3.04 WARRANTY

- A. The tank manufacturer shall warrant the tank against any defects in workmanship and materials for a period of one (1) year from the date of acceptance.

END OF SECTION

SECTION 13203

FABRICATED STEEL HYDROPNEUMATIC TANK

PART I      G E N E R A L

1.01    SECTION INCLUDES

- A.      Horizontal, fabricated steel hydropneumatic tank, complete with accessories as specified and shown on the Drawings, to be shop fabricated and installed on Owner's site.

1.02    REFERENCES

- A.      ANSI - American National Standards Institute
- B.      ASME - American Society of Mechanical Engineers
- C.      ASTM - American Society for Testing and Materials
- D.      AWWA - American Water Works Association
- E.      NACE - National Association of Corrosion Engineers
- F.      NSF - National Sanitation Foundation
- G.      30 TAC 290 D - Rules and Regulations for Public Water Systems

1.03    QUALITY ASSURANCE

- A.      Manufacturer's Qualifications: Tank manufacturer shall be a specialist in the design, fabrication and coating of hydropneumatic (pressure) tanks. The manufacturer shall be quality certified, having an active ASME Code Stamp. Only ASME certified welders shall be allowed to do welding on the tank.
- B.      The design, fabrication, inspection, testing and stamping of the tank shall be in accordance with the latest edition of the ASME Boiler and Pressure Vessel Code ANSI/ASME Section VIII, Rules for Construction of Pressure Vessels, Division 1, Parts UG, UW and Parts UCS and/or UHA. Fabrication of the tank shall be in strict accordance with Subsection B, Part UW of the referenced code and based on a maximum allowable working stress of 75 psi. The fabricated tank shall be hydrostatically test to 113 psi. The Manufacturer shall furnish to the Engineer six copies of the shop drawings which clearly confirm that the tank will be fabricated in accordance with the code. Prior to delivery, the Manufacturer shall furnish to the Engineer two copies of Form U-1A, Manufacturer's Data Report on Pressure Vessels.

1.04    SUBMITTALS

- A.      Submit shop drawings and product data under provisions of Section 01300 including the following:

1. All major dimensions
  2. Design and construction notes
  3. Material documentation.
  4. Schedule of openings
  5. Weld attachment details
  6. Protective coating system.
- B. Submit evidence of ASME certification of shop and welders who will be working on the tank.
- C. Provide design calculations for fabrication of the tank, prepared and sealed by a State of Texas Registered Professional Engineer.

#### 1.05 DESIGN CRITERIA

Product:	Chlorinated Drinking Water
pH:	6 to 9
Temperature:	Ambient (33 to 100 degrees Fahrenheit)
Nominal Capacity:	2,535 gallons
Diameter:	72 inches
Length, seam to seam:	10 feet 1/16 inches
Design Working Pressure:	75 psig
Test Pressure Required:	113 psig
Safety Factor for shell design:	4:1
Corrosion allowance required:	1/8 inch (in addition to calculated thickness)

#### 1.06 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01730.

#### 1.07 DELIVER, STORAGE AND HANDLING

- A. Deliver, store, and protect tank in accordance with provisions of Section 01600.

### PART 2      P R O D U C T S

#### 2.01 MATERIALS

- A. All products and materials that come into contact with potable water must conform to ANSI/NSF Standard 61.
- B. Lead Ban: The use of pipes, pipe fittings, plumbing fittings and fixtures that contain more than 0.25 percent lead is prohibited.



- C. Tank Structure: The materials, design fabrication and erection of the hydropneumatic tank must meet the standards of ASME Section VIII, Division 1 Codes and Construction Regulations and must have an access port for periodic inspections. An ASME name plate must be permanently attached to the tank.
  - 1. Steel: Steel plates and shapes shall conform to the requirements of ASTM A36 with a minimum yield strength of 36,000 psi.
- D. Flanges: All flanges to be ANSI 150 lb. standard raised face type, forged of Specification SA-181 steel.
- E. Threaded Connections: All threaded connections shall be 3,000 lb half or full couplings of forged carbon steel meeting Specification SA-105 and FNPT threads complying with the latest standards of A-SO B2.1.
- F. Stiffener Rings: Not allowed, the tank manufacturer shall provide the shell thickness required so as not to have internal or external stiffener rings.

## 2.02 APPURTENANCES

- A. The tank shall be equipped with the following appurtenances in accordance with locations shown on the Drawings.
  - 1) One 4-inch flanged connection at bottom of head for inlet
  - 2) One 4-inch flanged connection at bottom of head for discharge.
  - 3) One 2-inch half coupling in bottom for drain.
  - 4) One 2-inch FNPT lb. coupling at top for air supply piping, and probe.
  - 5) One 2-inch FNPT coupling at mid-tank level for air volume control valve and pressure gauge.
  - 6) One 2-inch FNPT coupling at top of tank for safety pressure relief valve.
  - 7) One 2-inch FNPT coupling at top of tank for air release valve.
  - 8) One 2-inch FNPT coupling at top of tank for spare.
  - 9) Two 1/2-inch FNPT couplings in end of tank for gauge glass accessories.
  - 10) Two 14-inch by 18-inch elliptical manway on head of tank (one on each end).
  - 11) Two 6-inch high center web type saddle assemblies with wear plate as required, seal welded to tank.

2.03 ACCESSORIES

- A. The Contractor shall furnish and install the accessories as shown on the Drawings, specified herein and/or as required by AWWA D-100 and TCEQ RG-195, June 2002 Rules and Regulations for Public Water Systems.
1. Air Release/Pressure Gauge: Install air release/pressure gauge assembly at the location shown in the Drawings. Parts and movement shall be stainless steel.
  2. Air Relief Valve: Furnish and install an air relief valve at the location shown on the Drawings.
  3. Valving: All valving on lines under pressure shall be of the slow closing type to prevent water hammer and reduce the chance of tank failure.
  4. Airline Filter: Furnish and install in-line compressed air filter to remove contaminants and compressor lubricant from air supplied to the hydropneumatic tank. Use Grainger Item # 1EJV7, 58 cfm, 40 micron, 300 psi, 300° F rated bronze inline filter or approved equal.

2.04 PAINTING AND PROTECTIVE COATING

- A. General: The tank shall be prepared, blasted, cleaned, primed and finish coated on the inside and the outside by the tank manufacturer prior to tank delivery.
- B. All protective coating applied to the tank shall be in strict accordance with current AWWA standards. **No temporary coatings, wax grease coatings or coating material containing lead will be allowed.** No other coatings will be allowed which are not approved for use (as a contact surface with potable water) by the United States Environmental Protection Agency (EPA), National Sanitation Foundation (NSF), or the United States Food and Drug Administration (FDA). All newly installed coatings must confirm to ANSI/NSF Standard 61 and must be certified by an organization accredited by ANSI. Data sheets furnished by the coating manufacturer shall be submitted with the shop drawings of the tank.
- C. Interior Coating: Tank shall be sand blasted to SSPC SP-10 “Near White Finish”, then coated in accordance with the following:
1. Tanks 5,000 gallons and less: 3 coats of Tnemec Series N140, polyamide amine epoxy, 4-6 mils each, minimum dry film thickness of 12 mils.
  2. Tanks 5,000 gallons and greater: 3 coats of Tnemec Series 20 Polyamide Epoxy 4-6 mils each, minimum dry film thickness of 12 mils.
- D. Outside Coating: Tank shall be sand blasted to SSPC SP-6 “Commercial Finish”, then coated in accordance with the following:
1. Tanks 5,000 gallons and less: 2 coats of Tnemec Series N140, polyamide amine epoxy, 3-5 mils each and one finish coat of Aliphatic Polyurethane 2-3 mils, minimum dry film thickness of 8 mils.

2. Tanks 5,000 gallons and greater: 2 coats of Tnemec Series 20 Polyamide Epoxy 3-5 mils each, and one finish coat of Aliphatic Polyurethane 2-3 mils, minimum dry film thickness of 8 mils.
3. Other coating manufacturers with similar products will be considered.

### PART 3      EXECUTION

#### 3.01    FIELD INSTALLATION

- A. Install on a concrete saddle supports as shown on the Drawings. Use 4 - 1/2-inch diameter stainless steel anchor bolts to attach each tank saddle to the concrete support.

#### 3.02    TANK DISINFECTION

- A. Disinfection must be performed in accordance with AWWA requirements and water samples must be submitted to a laboratory approved by the Texas Department of Health. The sample results must indicate that the facility is free of microbiological contamination before it is placed into service.
- B. Fill the tank with a 50 mg/l chlorine solution made using potable water. Allow the solution to remain in the tank for 24 hours, then flush and refill with potable water and monitor. When the residual in the tank is reduced to 1-2 mg/l total residual chlorine, the sampling and testing of samples for bacteriological contamination may begin.

#### 3.05    WARRANTY

- A. The tank manufacturer shall warrant the tank against any defects in workmanship and materials for a period of one (1) year from the date of acceptance.

END OF SECTION

SECTION 13441

WELL/BOOSTER PUMP CONTROL PANEL

PART 1    G E N E R A L

1.01    SECTION INCLUDES

- A.    Control panel complete and operational with required components to operate the four booster pumps as shown and specified.

1.02    REFERENCES

- A.    Reference Standards: Comply as a minimum with applicable provisions and recommendations of the following:
  - 1.    NEC, National Electric Code.
  - 2.    NEMA, Standards of National Electrical Manufacturers Association.
  - 3.    IEEE, Institute of Electrical and Electronic Engineers.
  - 4.    UL, Underwriters Laboratories.

1.03    QUALITY ASSURANCE

- A.    All materials used shall be new and of high grade and of properties best suited to the Work required.
- B.    Manufacturer's Qualifications:
  - 1.    Control equipment provided under this Section shall be assembled by a manufacturer whose products have proven reliable in similar service for at least five (5) years. Panel shop to be UL approved.
  - 2.    Manufacturer shall satisfy the engineer that they are capable of providing local factory trained personnel to warranty the control panel when needed within a 24-hour period.

1.04    DESIGN

- A.    Control panel shall be designed to receive signals from externally mounted pressure switches with the following functions (**by Others**).

1. PS3 shall be Mercoird #DA-31-153-1 (1-30 ft) and shall provide low pressure alarm, and a 4-20 MA signal to the telephone dialer
2. PS4 shall be Mercoird #DA-31-153-1 (1-30 ft) and shall provide low level cut-off/on signal to prevent booster pumps from running when the GST level is low.
3. PS5, PS6 and PS7 shall be Mercoird #DA-31-153-6 (5-100 psi) and shall provide on/off signals to the booster pumps and a 4-20 MA signal to the telephone dialer.
4. PS8 shall be Mercoird #DA-31-153-6 (5-100 psi) and shall provide low pressure alarm, and a 4-20 MA signal to the telephone dialer

#### 1.05 SUBMITTALS

- A. Submit shop drawings and product data including descriptive literature, wiring diagram and a list of all components used in the manufacture of the panel, complete with manufacturer's part and/or model numbers.

### PART 2 PRODUCTS

#### 2.01 GENERAL

- A. Furnish control panel in accordance with these specifications as shown on the contract drawings.
- B. Capacity: Control Panel shall be designed to control four (4) 25 HP booster pumps.
- C. Design: Monitoring and control system to be designed to function with motor units and to be factory wired and tested.
- D. Power supply shall be 460 volts, 3 phase, 60 hertz.
- E. Major Components:
  1. Enclosure: Shall be NEMA 4X 304 Stainless Steel construction. The enclosure door shall be fastened securely with pad-lockable hand-operable three-point draw latches. The minimum enclosure size shall be 36" wide x 42" tall x 12" deep.

2. Backplate: Shall be 1/4" powder coated steel.
3. Power Distribution Block: Three pole with ground lugs as required, Square D or approved equal.
4. Inner door (Dead Front)
5. Lightning & Surge Arrestors
6. Motor Circuit Breakers: Square D Mag Guard Circuit Breakers rated for a minimum of 125% of motor amps shall be provided for each motor.
7. Motor Starters: Shall be Square D NEMA rated FVNR Size 2 Open Type Motor Starters w/ adjustable motor logic solid state overload relay and internal auxiliary relays.
8. Phase Monitor.
9. Fuse holder and fuses.
10. Provide power transformer to supply internal control 120 voltage.
11. Time Delay Relays: Provide an adjustable time delay relay (0.1 -10 minutes) for all motors to prevent units from coming on all at once after a power outage.
12. Alternating Relay: Provide Diversified Electronics Quadraplex Alternating Relay with selector switch, Zelio Smart Relay Quadraplex Controller, or approved equal.
13. Selector Switches: Shall be connected to operate in the hand, off or automatic mode for each motor individually. Selector switches shall be 22 mm NEMA 4X. Mount on the exterior door of enclosure.
14. Pilot Lights: Provide one pilot light for each motor to indicate that motor is running. Pilot lights shall be designed to replace bulbs by removing the lens cap, not by removing the fixture. Pilot lights shall be 22 mm NEMA 4X. Mount on the exterior door of enclosure.
15. Control power light (white)
16. Common overload auxiliary contact.
17. Low Suction Cutout 22 mm Pilot light (Door Mounted)
18. Low Suction Auxiliary Contact

19. Elapsed Time Meters: Mount on exterior door of enclosure.
20. Auto Dialer: Install Sensaphone Sentinel Auto Dialer inside panel to provide emergency notification of low GST level or low system pressure. Provide all components required for cellular dialing.
21. External Alarm Light: Federal light or equal.
22. External Horn: 95 dba with external silence switch.
23. Install 30 slot terminal block in lower part of enclosure.
24. Install terminal grounding lug in lower part of enclosure.
25. Provide permanent nameplates for each switch, light, and timer mounted on door of enclosure.
26. Print Pocket: Install on inside of outer door.
27. Construction: All internal wiring shall be neat and concealed in 1" wide x 2" tall wireway. Control wiring shall be red 14 gauge minimum. Power and lighting wiring shall be black 12 gauge minimum, properly sized. Neutral wiring shall be white. Ground wiring shall be green. Each wire shall terminate in screw or lug terminal connection. All internal wiring shall be numbered or labeled at termination using "Scotch Code" or equivalent type wire markers.
28. Panel shall be tested to perform as designed through the entire sequence of operation before it leaves the factory. Panel shall include a permanent sticker that is signed by the person who built, wired, and tested the panel.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Installation of the control panel shall be in complete accordance with the manufacturer's instructions and recommendations, and the reviewed shop drawings.
- B. Field Tests: control panel will be subjected to a field operational test before acceptance.

3.02    WARRANTY

- A.      Manufacture shall provide warranty at point of installation and shall not require returning the control panel to the factory for service.

END OF SECTION



SECTION 15066

STEEL PIPING

PART 1      G E N E R A L

1.01    SUBMITTALS

- A.      Submit shop drawings showing design of new pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fittings, flanges, and special details.

1.02    QUALITY CONTROL

- A.      All products and materials that come into contact with potable water must conform to ANSI/NSF Standard 61
  
- B.      Lead Ban: the following provisions are herein adopted and apply to the use of lead in plumbing:
  - 1.      The use of pipes and pipe fittings that contain more than 8.0 percent lead or solders and flux that contain more than 0.2 percent lead is prohibited in the following circumstances:
    - a.      For installation or repair of any public water supply
    - b.      For installation or repair of any plumbing in a residential or nonresidential facility providing water for human consumption and connected to a public drinking water supply system
  
- C.      No previously used piping may be incorporated into the work
  
- D.      Welding shall comply with AWS D1.1

1.03    HANDLING

- A.      Store pipe materials off the ground and in a manner as to prevent damage.
  
- B.      Cover ends to prevent foreign materials from entering pipe and to prevent damage to pipe ends.
  
- C.      Handle thin wall pipe and factory beveled ends in accordance with manufacturer's recommendations.
  
- D.      Handle pipe, fittings and accessories to ensure installation in work is in sound undamaged condition.

- E. Do not use equipment, tools and methods used in unloading, reloading, hauling and laying pipe and fittings that will damage materials.
- F. Hooks inserted in ends of pipe shall have broad, well-padded contact surfaces.

**PART 2      P R O D U C T S**

**2.01    GENERAL PURPOSE CARBON STEEL PIPE**

**A.      Pipe**

- 1. 6-inch and smaller: Welded or seamless, ASTM A-53, Grade A or B, Type E or S, plain ends.
- 2. 8-inch and larger: Welded or seamless, ASTM A-53, Grade A or B, Type E or S, beveled ends.
- 3. Minimum thickness shall comply with following nominal pipe sizes:
  - a. 2-inch:
    - 1. 2.375-inch outer diameter (O.D.)
    - 2. 0.154-inch minimum wall thickness
    - 3. 3.653 pounds per linear foot (approximate), uncoupled
  - b. 4-inch:
    - 1. 4.50-inch outer diameter (O.D.)
    - 2. 0.237-inch minimum wall thickness
    - 3. 10.79 pounds per linear foot (approximate), uncoupled
  - c. 6-inch:
    - 1. 6.625-inch outer diameter (O.D.)
    - 2. 0.280-inch minimum wall thickness
    - 3. 18.97 pounds per linear foot (approximate), uncoupled
  - d. 8-inch:
    - 1. 8.625-inch outer diameter (O.D.)
    - 2. 0.322-inch minimum wall thickness
    - 3. 28.55 pounds per linear foot (approximate) uncoupled
  - e. 12-inch:
    - 1. 12.750-inch outer diameter (O.D.)
    - 2. 0.375-inch minimum wall thickness
    - 3. 49.56 28.55 pounds per linear foot (approximate) uncoupled

**B.      Fittings**

1. Bends shall be long radius
2. Dimensions shall conform to AWWA C208
3. 2-1/2 inch through 6-inch: Standard weight, factory forged steel, butt weld ends, ASTM A 234 WPB and ANSI B16.9
4. 8-inch through 24-inch: Standard weight, factory forged steel, butt weld ends, ASTM A 234 and ANSI B16.9.
5. Wall thickness: Equal to or greater than pipe to which fitting is welded

C. Flanges, Bolting and Gaskets

1. Flanges: AWWA C207, Class D or ANSI B16.1
2. Bolting, carbon steel: ASTM A 307, Grade B
3. Carbon Steel hexagonal nuts: ASTM A 194, 2H
4. Gaskets: FS HH-P-46 or ASME B16.21, full face, compressed asbestos, 1/16 inch thick

2.02 STEEL PIPE COUPLINGS

- A. Gasketed steel sleeve with two steel followers and two rubber compound, wedge section gaskets
- B. In air piping use gaskets with minimum temperature rating of 200 degrees Fahrenheit
- C. Sufficient track-head 40,000 psi yield strength, rolled thread steel bolts and corrosion resistant steel nuts to compress gaskets so water at 200 psi will not leak from coupling
- D. Acceptable product: Dresser Style 38 or approved equal

2.03 STEEL PIPE EXPANSION JOINTS

- A. Single or double end
- B. Welded steel construction
- C. Alternate split rubber compound and split jute rings
- D. In air piping use gaskets with minimum temperature rating of 200 degrees Fahrenheit
- E. Will not leak at 200 psi water pressure
- F. Acceptable Product: Dresser Style 63 or approved equal

2.04 STEEL PIPE COATINGS

- A. Water Service
  - 1. Interior Coatings: AWWA C205, cement mortar lining for pipe, fittings and joints, factory applied unless hot dip galvanized
  - 2. Exterior Coatings
    - a. Surface preparation: Clean to bare metal, SSPC 6
    - b. Buried service: Thixotropic coal tar mastic; Acro 4467 Coal Tar Epoxy, Koppers Bitumastic No. 50, Tnemec 46-450 Themecol or approved equal.
    - c. Aboveground service: All aboveground water lines shall be galvanized iron pipe. All fittings and connectors shall also be galvanized iron to match pipe.
- B. Laying Lengths:
  - 1. 20 feet single random lengths
  - 2. Shop fabricated pieces of proportions to facilitate transportation to job site
- C. Seams:
  - 1. Girth: 20 feet ransom maximum spacing
  - 2. Longitudinal: Maximum number for 4-inch through 24-inch pipe is one
- D. Fittings:
  - 1. Minimum of 15-degree angular change for shop fabricated miter turns
  - 2. Inside dimensions shall match adjoining pipe
  - 3. Thickness shall be same or greater than adjoining pipe

### **PART 3      EXECUTION**

#### **3.01      PREPARATION**

- A. Repair pipe coating which has been damaged before installation of pipe.

#### **3.02      INSTALLATION**

- A. All pipe fittings that are to be buried shall be mechanical joint fittings.
- B. Flanged Joints;

1. When bolting flanged joints, ensure there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or would cause unnecessary stress in flanges
  2. The flange shall be free to move in any direction while flange bolts are being tightened
  3. Tighten bolts gradually and at uniform rate with gasket compression uniform over entire area of gasket
  4. To provide maximum flexibility and ease of alignment correction by taking advantage of slack between flange bolts and bolt holes for slight angular rotation of connecting piping with gaskets in place, with only portion of flange bolts (not less than four per joint) installed
- C. Flanged joints between steel and cast-iron flanges shall be electronically isolated
1. Use epoxy-coated bolts, nuts and washers
  2. Install insulating type gasket
- D. Pipe Supports:
1. Each length of steel pipe shall be continuously supported by pipe bedding if buried; and shall be supported at two points approximately one-quarter length in from joints by one anchored (fixed) and one sliding support when installed above ground
  2. Lower 120 degree of pipe circumference shall be contact supported at each support
- E. Reaction Anchorage and Blocking: Provide plugs, caps, tees, and bends deflecting 22-1/2 degrees or more with concrete thrust blocking placed between solid ground and item to be anchored, adequate to resist reactive forces without movement

### 3.03 FIELD QUALITY CONTROL

- A. Hydrostatic test piping at 150 psi
- B. Inspect and test coatings and repair or replace defects

END OF SECTION

## SECTION 15105

## GATE VALVES

## PART 1 GENERAL

## 1.01 SUBMITTALS

## A. Product Data:

1. Submit catalog cut sheet for each different product make and model proposed for installation.
2. Submit chart for each make, model, and size of valve proposed for installation:
  - a. Flow through valve versus pressure drop.
  - b. Percent of maximum flow versus valve percent open.
  - c. Flow versus head loss.

B. Affidavit of Compliance: Manufacturer shall supply affidavit of compliance with stated reference standards and specified provisions of this Section when requested by Engineer.

C. Provide valves in compliance with submitted certified drawings and material specifications.

D. When requested by Engineer, provide certified records of ASTM or other specified tests met by valve.

## PART 2 PRODUCTS

## 2.01 GATE VALVES

- A. 3 In. and Larger Gate Valves: AWWA C509, resilient-wedge gate type, non-rising stem.
- B. Gate Valves Smaller Than 3 In. Size: Solid wedge type.
- C. Provide buried valves with valve boxes.

## 2.02 VALVE BOXES

- A. Cast iron, extension sleeve type, suitable for depth of cover shown on Drawings.
- B. Not less than 5 in. in diameter, and thickness at any point of not less than 3/16 in.

- C. Provide valve boxes with suitable cast iron bases and covers.
- D. Covers: Cast thereon on appropriate name designating service for which valve is used.
- E. Parts of Valve Boxes, Bases, and Covers: Coated by dipping in bituminous varnish, FS TT-V-51.

2.03 RELATED ITEMS

- A. Manual Operators: Provide valves with operators equipped with operating wheel, except valves equipped with power actuated operators or designed for automatic operation.
- B. Wrench Nuts:
  - 1. Provide wrench nuts on buried valves, on valves which are operated through floor boxes, and where shown on Drawings.
  - 2. Wrench nuts shall comply with Section 19, AWWA C500.
  - 3. Provide not less than two operating keys for operation of wrench nut operated valves.
- C. Rotation Indicator:
  - 1. Each valve body or operator shall have cast work OPEN and arrow indicating direction to open.
  - 2. Direction of rotation of wheel, wrench nut, or lever to open valve: Left, counterclockwise.
- D. Ends:
  - 1. 3 in. or larger buried valves: Push-on or mechanical joint ends.
  - 2. Other 3 in. or larger valves: Flanged ends.
  - 3. 2-1/2 in. or smaller valves: Threaded or solder ends.
  - 4. Flanges: ANSI B16.1, 125 lb.
  - 5. Push-on and mechanical joints: ANSI/AWWA C111/A21.11.

- F. Unions: Provide union or flanged connection within 2 ft. of each threaded end valve unless valve can be otherwise easily removed from piping.

#### 2.04 SHOP PAINTING

- A. Shop paint ferrous metal surfaces of valves and accessories, both interior and exterior, for corrosion protection.
- B. Protect internal and external iron surfaces of valves with coating of 10 mils dft of two-part thermosetting epoxy: AWWA C550.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install valves in accordance with manufacturer's recommendations.
- B. Valve Boxes:
  - 1. Set valves and valve boxes plumb; place each valve box directly over valve it serves, with top of box brought flush with finished grade.
  - 2. After being placed in proper position, fill in earth around each valve box and thoroughly tamp on each side of box.

END OF SECTION