FOR

SEPTAGE RECEIVING STATION

Located in
The City of North Charleston,
Charleston County, South Carolina

Table of Contents

<table>
<thead>
<tr>
<th>Title</th>
<th>Page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information for Bidders</td>
<td>5</td>
</tr>
<tr>
<td>Bid</td>
<td>14</td>
</tr>
<tr>
<td>Bid Bond</td>
<td>17</td>
</tr>
<tr>
<td>Agreement</td>
<td>18</td>
</tr>
<tr>
<td>Certificate of Acknowledgement, for Agreement</td>
<td>21</td>
</tr>
<tr>
<td>Performance Bond</td>
<td>22</td>
</tr>
<tr>
<td>Payment Bond</td>
<td>24</td>
</tr>
<tr>
<td>Certificate of Acknowledgement, for Contract Bonds</td>
<td>26</td>
</tr>
<tr>
<td>Notice of Award</td>
<td>27</td>
</tr>
<tr>
<td>Notice to Proceed</td>
<td>29</td>
</tr>
<tr>
<td>Change Order</td>
<td>30</td>
</tr>
<tr>
<td>Request for Payment</td>
<td>31</td>
</tr>
<tr>
<td>General Conditions</td>
<td>33</td>
</tr>
</tbody>
</table>

GENERAL REQUIREMENTS

00700 General Conditions 00700-1 thru 00700-65
01002 Supplemental Conditions 01002-1 thru 01002-19
01150 Measurement and Payment 01150-1

TECHNICAL SPECIFICATIONS

02200 Earthwork 02200-1 thru 02200-5
02221 Excavation, Trenching and Backfilling for Utilities 02221-1 thru 02221-10
02500 Base Course and Bituminous Pavement 02500-1 thru 02500-5
03300 Cast-In-Place Concrete 03300-1 thru 03300-27
09900 Painting 09900-1 thru 09900-18
MANUFACTURERS EQUIPMENT SPECIFICATIONS

SEPTAGE RECEIVING STATION

LAKESIDE 40SAP RAPTOR SEPTAGE RECEIVING STATION (BASIS OF DESIGN)

HUBER RotoFAS SEPTAGE RECEIVING STATION (APPROVED EQUAL)

WETWELL PUMP

VAUGHN V4KR-080 RECIRCULATING CHOPPER PUMP (BASIS OF DESIGN)
INVITATION TO BID

Sealed bids will be received for the NCSD SEPTAGE STATION project at the North Charleston Sewer District Administrative Offices, 7225 Stall Road, North Charleston, South Carolina 29406 at 2:00 PM on May 14, 2020, at which time they will be publicly opened and read.

The work under this Contract will consist generally of the following:

The project consists of the installation of one (1) Lakeside Septage Receiving Station unit at the Felix Davis WWTP in North Charleston, SC. Also included in the design is construction of a receiving wet well accommodated by a chopper pump and the associated piping, construction of a concrete pad equipped with drains and paving to accommodate travel by septage hauling trucks.

All work on the Project must be completed within 180 consecutive calendar days of date of notice to proceed.

All questions concerning the Plans, Specifications and other Contract Documents should be directed to Jessica Hargrove, Hussey Gay Bell, 329 Commercial Drive, Savannah, Georgia, 31406, telephone (912) 354-4626 or jhargrove@husseygaybell.com.

Bids must be accompanied by a certified check or Bid Bond for 5 percent of the amount bid. Performance Bond and Payment Bond in the amount of 100 percent of the Contract amount will be required. To qualify to bid a certified statement from the Bidder’s bonding company shall accompany the Bid Bond stating that the Bidder can submit a Performance Bond to the Owner within seven days of award of Contract. South Carolina Licensee Number must be written on the bid package envelope.

A non-collusion affidavit must be completed and submitted with the bid.

The North Charleston Sewer District reserves the right to reject any or all bids and to waive technicalities and informalities.

NORTH CHARLESTON SEWER DISTRICT
7225 STALL ROAD
NORTH CHARLESTON, SC 29406
INFORMATION FOR BIDDERS

BACKGROUND: The project consists of the installation of one (1) Septage Receiving Station unit at the Felix Davis WWTP in North Charleston, SC. Also included in the design is the construction of a receiving wet well accommodated by a chopper pump and the associated piping, construction of a concrete pad equipped with drains and paving to accommodate travel by septage hauling trucks, miscellaneous electrical and controls for a fully functioning station and hauler access panel.

The Engineer for this Project is Jennifer Oetgen, P.E. of Hussey Gay Bell.

RECEIPT AND OPENING OF BIDS: Bids will be received at the North Charleston Sewer District Administrative offices until 2:00 PM, May 14, 2020, at which time all bids received will be publicly opened and read aloud. Optional site visits will be conducted by appointment April 20-23, 2020.

Bids may be delivered to:

Purchasing Department
North Charleston Sewer District
7225 Stall Road
North Charleston, South Carolina 29406

Or

Bids may be mailed to:

Purchasing Department
North Charleston Sewer District
PO Box 63009
North Charleston, South Carolina 29419

LICENSES: The attention of Bidders is directed to the provisions of the acts for licensing of General Contractors for the State of South Carolina and all requirements of such acts which have bearing upon this work shall be deemed as part of the Specifications as if written therein in full. The showing by the Contractor of his license number shall be deemed as the Contractor’s representation that he is legally qualified to enter into the prescribed Contract for any or all portions of the work included in his Bid.

All Bidders submitting a Bid shall have a current valid Contractor’s License for the State of South Carolina. This license number shall be shown on the bid form immediately below the signature identification and on the face of the sealed envelope containing the submitted Bid. Subcontractors who will be engaged by the General Contractor shall also hold the required licenses.
successful Bidder and all subcontractors will be required to obtain any business license required prior to beginning work, if said Bidder does not have the required license.

**BID SECURITY:** Each Bid must be accompanied by a certified check of the Bidder, or a Bid Bond duly executed by the Bidder as principal and having as surety thereon a surety company qualified to do business under the laws of the State of South Carolina and satisfactory to the Owner, in an amount not less than five percent (5%) of the Bid. Such check or Bid Bond will be returned to all except the three (3) lowest Bidders upon request, and the remaining checks or Bid Bonds will be returned upon request after the Owner and the accepted Bidder have executed the Agreement. If no award has been made within ninety (90) calendar days after the date of the opening of Bids, such check or Bid Bond will be returned upon request of the Bidder at any time thereafter, so long as he has not been notified of the acceptance of his Bid.

**GUARANTY BONDS:** The Bidder to whom the contract is awarded will be required to execute the Agreement and obtain the Performance Bond and Payment Bond, each in the sum of the full amount of the Contract Price, within ten (10) calendar days from the date when Notice of Award is delivered to the Bidder. The Bonds must be duly executed and acknowledged by the Bidder as principal and by a corporate surety company qualified to do business under the laws of the State of South Carolina and satisfactory to the Owner as surety, for the faithful performance of the Contract and payment for labor and materials. The premiums for such bonds shall be paid by the Contractor. Each Bond must be irrevocable, and valid for two years beyond the date of final acceptance of the project.

**EXECUTION OF CONTRACT:** The Owner, within ten (10) calendar days of receipt of acceptable Performance Bond, Payment Bond, and Agreement signed by the party to whom the Agreement was awarded, shall sign the Agreement and return to such party an executed duplicate of the Agreement. Should the Owner not execute the Agreement within such period, the Bidder may by written notice withdraw his signed Agreement. Such notice of withdrawal shall be effective upon receipt of the notice by the Owner.

**POWER OF ATTORNEY FOR BONDS:** Attorneys-in-fact who sign Bid or Performance or Payment Bonds must file with each Bond a certified and dated copy of their power of attorney.

**LIQUIDATED DAMAGES FOR FAILURE TO ENTER INTO CONTRACT:** The successful Bidder, upon his failure or refusal to execute and deliver the Contract and Bonds required within ten (10) calendar days after he has received notice of the acceptance of Bid, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his bid.
**LAWS AND REGULATIONS:** All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout, and they will be deemed to be included as though herein written out in full.

**IMPORTANT TAX NOTICE - NONRESIDENTS ONLY:**

Withholding Requirements for Payments to Nonresidents: Section 12-8-550 of the South Carolina Code of Laws requires persons hiring or contracting with a nonresident conducting a business or performing personal services of a temporary nature within South Carolina to withhold 2% of each payment made to the nonresident. The withholding requirement does not apply to (1) payments on purchase orders for tangible personal property when the payments are not accompanied by services to be performed in South Carolina, (2) nonresidents who are not conducting business in South Carolina, (3) nonresidents for contracts that do not exceed $10,000 in a calendar year, or (4) payments to a nonresident who (a) registers with either the S.C. Department of Revenue or the S.C. Secretary of State and (b) submits a Nonresident Taxpayer Registration Affidavit - Income Tax Withholding, Form I-312 to the person letting the contract.

The withholding requirement applies to every governmental entity that uses a contract ("Using Entity"). Nonresidents should submit a separate copy of the Nonresident Taxpayer Registration Affidavit - Income Tax Withholding, Form I-312 to every Using Entity that makes payment to the nonresident pursuant to this solicitation. Once submitted, an affidavit is valid for all contracts between the nonresident and the Using Entity, unless the Using Entity receives notice from the Department of Revenue that the exemption from withholding has been revoked.

For information about other withholding requirements (e.g., employee withholding), contact the Withholding Section at the South Carolina Department of Revenue at 803-898-5383 or visit the Department's website at: https://dor.sc.gov

This notice is for informational purposes only. This agency does not administer and has no authority over tax issues. All registration questions should be directed to the License and Registration Section at 803- 898-5872 or to the South Carolina Department of Revenue, Registration Unit, Columbia, S.C. 29214-0140. All withholding questions should be directed to the Withholding Section at 803-896-1420.

https://dor.sc.gov/forms-site/Forms/I312.pdf

**EXAMINATION OF DRAWINGS AND SPECIFICATIONS:** Each Bidder shall carefully examine Drawings and Specifications and all Addenda or other revisions thereto and thoroughly familiarize himself with the detailed requirements thereof prior to submitting a Bid. If any Bidder is in doubt as to the true meaning of any part of the Drawings, Specifications, or other Documents, or if any error, discrepancy, conflict, or omission is noted, the Bidder shall immediately contact the Owner in writing and request clarification. The Owner will clarify the intent of the Documents and/or correct such error, discrepancy, conflict, or omission, and will notify all Bidders by
Addendum in cases where the extent of work or cost thereof will be appreciably affected. No allowance will be made after Bids are received for oversight by Bidder.

EXAMINATION OF SITE: Each Bidder must visit the site of proposed work and fully acquaint himself with conditions relating to construction and labor so he may fully understand facilities, difficulties, and restrictions attending execution of work under contract. By executing the Agreement, the Contractor represents that he has visited the site, familiarized himself with the local conditions under which the work is to be performed, and correlated his observations with the requirements of the Contract Documents. The Bidder shall confine examination to the specific areas designated for the proposed construction, including easements and public Right-of-ways. If, due to some unforeseen reason, the Owner’s proceedings for obtaining the proposed construction site (including easements) have not been completed, the Bidder may enter the site only with the express consent of the property owner. The Bidder is solely responsible for any damages caused by his examination of the site.

INFORMATION NOT GUARANTEED: All information given on the Drawings or in the Contract Documents relating to subsurface conditions, existing structures, location of utilities, sewer inverts, or other information on existing facilities is from the best sources at present available to the Owner. All such information is furnished only for the information and convenience of the Bidders.

It is agreed and understood that the Owner does not warrant or guarantee that the conditions, pipes, or other structures encountered during construction will be the same as those indicated on the Drawings or in the Contract Documents. The Bidder must satisfy himself regarding the character, quantities, and conditions of the various materials and the work to be done.

It further is agreed and understood that the Bidder or the Contractor will not use any of the information made available to him or obtained in any examination made by in any manner as a basis or ground of claim or demand of any nature against the Owner or Engineer, arising from or by reason of any variance which may exist between the information offered and the actual materials or structures encountered during the construction work, except as may otherwise be provided for in the Contract Documents.

If any work is performed by the Contractor, or any subcontractor, prior to adequate verification of applicable data, any resultant extra cost for adjustment of work necessary to conform to existing conditions, or damage to existing facilities, shall be assumed by the Contractor without reimbursement or compensation by the Owner.

COMPLETE WORK REQUIRED: It is the intent of the Drawings and Specifications to provide a complete and usable facility. The Contractor’s work shall be based on the Drawings and Specification, but shall include all materials and appurtenances are shown on the Drawings or described in the Specifications.
The Drawings, Specification, and all supplementary documents are essential parts of the Contact, and requirements occurring in one are as binding as though occurring in all. They are intended to be cooperative, to describe and provide for a complete work. In case of discrepancy on the Drawings, figured dimensions shall govern. In case of omissions from the Specification as to items of equipment and materials or quantities therefore, the Drawing shall govern.

**It shall be the responsibility of the Bidder to call to the attention of the Engineer obvious omissions of such magnitude as to affect the strength, adequacy, function, completeness, or cost of any part of the work in ample time for amendment by Addendum prior to bid opening date.**

**ADDENDA AND INTERPRETATIONS:** No interpretation of the meaning of the Drawings, Specifications, or other Bid Documents will be made orally to any Bidder by the Engineer or Owner prior to award of the contract.

Every request for such interpretation should be in writing and emailed to purchasing@ncsd.sc.gov. To be given consideration, such request must be received no later than **10:00 am, May 5, 2020**. All such interpretations and any supplemental instructions will be made in the form of written Addenda to the Specifications which, if issued, will be posted on the Purchasing website at www.ncsd.sc.gov/purchasing. Failure of any bidder to receive any such Addendum or interpretation shall not relieve such Bidder from any obligation under his Bid as submitted. All Addenda so issued shall become part of the Contract Documents.

**ABILITY AND EXPERIENCE OF BIDDER:** It is the purpose of the Owner not to award this Contract to any Bidder who does not furnish satisfactory evidence that he has the experience of successfully completing projects of this type and magnitude and that he has sufficient capital, equipment, plant, and personnel to enable him to prosecute the work successfully and to complete it in the time named.

The Owner may make such investigations as it deems necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the Owner, under oath if so required, all such information and data for this purpose as the Owner may request.

**BIDS AND QUALIFICATIONS:** Before a Bid is considered for award, the Bidder may be requested by the Engineer or Owner to submit a statement of facts in detail as to his previous experience in performing similar or comparable work, and of his business and technical organization and financial resources and plant available to be used in performing the contemplated work.

**TIME FOR COMPLETION:** The Bidder must agree to commence work within 15 days of the notice to proceed stipulated in the Agreement. The Bidder also must agree to fully complete the project within **180** consecutive calendar days.
LIQUIDATED DAMAGES: The Bidder must agree to pay as liquidated damages the amount set forth in the Agreement for each consecutive calendar day that the work is incomplete after the agreed upon date of completion.

WITHDRAWAL OF BIDS: Any Bidder may withdraw his Bid, either personally or by written request, at any time prior to the scheduled opening of Bids or authorized postponement thereof. Otherwise, Bidder may not withdraw his Bid for a period of ninety (90) calendar days after the date set for the opening thereof, and all Bids shall be subject to acceptance by the Owner during this period.

IRREGULAR BIDS: A Bid will be considered irregular and may be rejected for any one of the following reasons:

1. If the Bid is on a form other than that furnished by the Owner, or if the form is altered or any part detached.

2. If there are unauthorized additions, conditional or alternate bids, or irregularities of any kind which tend to make the Bid incomplete, indefinite, or ambiguous in its meaning.

3. If the Bidder adds any provisions reserving the right to accept or reject an award, or to enter into a contract pursuant to an award.

4. If the Bid does not contain a price for each item listed.

5. If the Bid does not contain the aggregate of the Bid, obtained by adding the extended amounts of the various items, if applicable.

6. If the Bid contains obviously unbalanced bid prices.

7. If there is reason to believe that any Bidder is interested in more than one Bid on the same project or that there has been collusion among the Bidders.

DISQUALIFICATION OF BIDDERS: More than one Bid from an individual, a firm or partnership, a corporation or any association, under the same or different names, will not be considered. Reasonable grounds for believing that any Bidder is interested as a principal in more than one Bid for the work contemplated will cause the rejection of all Bids in which such Bidder is believed to be interested. Any or all Bids will be rejected if there is reason to believe that collusion exists among the Bidders. Contracts will be awarded only to responsible Bidders capable of performing the class of work contemplated within the time specified, and having sufficient resources and finances to carry on the work properly.

ACCEPTANCE OR REJECTION OF BIDS: The Owner reserves the right to reject any and all Bids when such rejection is in the interest of the Owner; to reject the Bid of a Bidder who has previously failed to perform properly or complete on time contracts of a similar nature; and to reject the Bid of a Bidder who is not, in the opinion of the Engineer or Owner, in a position to perform the Contract. The Owner reserves the right to waive any informalities and technicalities
in bidding. The Owner may also accept or reject any of the alternates that may be set forth on the Bid.

**METHOD OF AWARD:** The Contract will be awarded to the responsive, responsible Bidder submitting the lowest Bid complying with the conditions of the Contract Documents. Award will be made on the basis of the prices given in the Base Bid or a combination of the Base Bid and Alternate, at the Owners option. The Bidder to whom the award is made will be notified.

A responsive Bidder submits a Bid in the proper form without qualifications or intent other than as called for in the Contract Documents and who binds himself or herself on behalf of the Bid to the Owner with the proper Bid Bond completed and attached, and who properly completes all forms required to be completed and submitted at the time of the Bidding. The Bidder shall furnish all data required by these Contract Documents. Failure to do so may result in the Bid being declared non-responsive.

A responsible Bidder can fulfill the following requirements:

a. The Bidder shall maintain a permanent place of business. This requirement applies to the Bidder where the Bidder is a division of a corporation, or where the Bidder is 50 percent or more owned by a person, corporation or firm.

b. The Bidder shall demonstrate adequate construction experience and sufficient equipment resources to properly perform the work under and in conformance with the Contact Documents. This evaluation will be based upon a list of completed or active projects and a list of construction equipment available to the Bidder to perform the work. The Owner may make such investigations as deemed necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the Owner all such information and data for this purpose as the Owner may reasonably request. The Owner reserves the right to reject any Bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Contract and to complete the Project contemplated therein.

c. The Bidder shall demonstrate financial resources of sufficient strength to meet the obligations incident to the performance of the work covered by these Contract Documents. The ability to obtain the required Performance and Payment bonds will not alone demonstrate adequate financial capability.

Acceptance of the Bidder’s documentation and substantiation or Contract Award by the Owner does not relieve the Bidder of liability for non-performance covered in the Contract Documents, nor will the Bidder be exempted from any other legal recourse the Owner may elect to pursue.

**PRE-CONSTRUCTION CONFERENCE:** After the Contractor signs the AGREEMENT, and submits all required documents, and prior to issuance of the NOTICE TO PROCEED, a pre-construction conference will be held with representatives of the Owner, Contractor, and the Engineer. At this conference, the construction schedule and inspection schedule will be approved.
Any problems with the Plans & Specifications will be resolved, and the Project Staff of the Owner and the Contractor will receive approval.

**NOTICE TO PROCEED:** The Notice to Proceed will be issued within ten (10) calendar days of the execution of the Agreement by the Owner. Should there be reasons why the Notice to Proceed cannot be issued within such period, the time may be extended by mutual agreement between the Owner and Contractor. If the Notice to Proceed has not been issued within the ten (10) calendar day period or within the period mutually agreed upon, the Contractor may terminate the Agreement without further liability on the part of either party.

**ESTIMATED QUANTITIES:** Bidders must satisfy themselves of the accuracy of the estimated quantities in the Bid Schedule by examining the site and reviewing the Specifications, Drawings, and Addenda. After Bids have been submitted, the Bidder shall not assert that there was a misunderstanding concerning the quantities of work or of the nature of the work to be done.

**COMPARISON OF BIDS:** Bids will be compared on the basis of the prices stated in the Bid. If there is a discrepancy between the unit price and or the computed total amount, the unit price shall govern.

**EASEMENTS:** The Owner has obtained, or will obtain, permanent easements and temporary construction easements through private property. The temporary construction easements entitle the Contractor to the occupancy and use of the designated area near or adjacent to the work for purposes related to the work. The Contractor will not encroach on any property unless it has been established that easements have been obtained. On all other land, the Contractor has no rights unless he obtains permission from the proper parties.

**WORK IN STATE AND COUNTY RIGHT-OF-WAYS:** The Owner will obtain the necessary easements and permits for construction across City, County and State Highway right-of-ways. The Contractor shall abide by all rules, regulations, and requirements of these agencies in regard to construction under this contract, including the giving of notices, provisions for inspections, and employment of such methods of construction as may be required. Wherever these Specifications may be in conflict with the regulations or requirements of these agencies, such regulations shall govern and these Specifications shall be modified to such extent as necessary to conform to the said rules, regulations, and requirements. Wherever additional costs are incurred due to requirements of these agencies, such additional periods of maintenance, special features of construction, etc., all such costs shall be included in the prices bid. No additional compensation will be allowed for such costs after award of the Contract.

**ITEMS AND INDETERMINATE ITEMS:** The work to be done under this Contract has been divided into items so that the actual quantity of work executed under each item may be paid for at the unit price bid for the particular item even though such quantity is greater or less than the estimated quantity stated in the Bid.

**RIGHT TO INCREASE OR DECREASE THE AMOUNT OF WORK:** The work comprises approximately the quantities shown in the bid form which will be used as a basis for comparison
of Bids and not for final estimate. The Owner does not, by expression or by implication, agree that the actual amount of work shall correspond with the estimated quantities.

The Owner reserves the right to alter the quantities of work to be performed or to extend or shorten the improvements at any time when and as found necessary, and the Contractor shall perform the work as altered, increased or decreased. Payment for such increased or decreased quantity will be in accordance with General Conditions subsection 7.11 entitled Payment for Extra Work. No allowance will be made for any change in anticipated profits nor shall such changes be considered as waiving or invalidating any conditions or provisions of the Contract and Bond.

**FORM OF BID:** All Bids must be submitted on the blank bid form provided therefore and must state the total price for which the Bidder will complete the work in accordance with the terms of the Contract Documents. All blank spaces must be filled in and there shall be no interpretations, alterations, or erasures.

The Bid must be signed manually by a principal or an officer duly authorized to make contracts. The Bidder’s legal name must be fully stated and the name and title of the person signing must be typed below his signature.

**SUBMITTING BIDS:** Each Bid must be submitted on the prescribed bid form. All blank spaces for bid prices must be filled in, in ink or typewritten, and the Bid must be fully completed and executed when submitted. Only one copy of the bid form is required.

Bidders are cautioned that it is the responsibility of each individual Bidder to assure that his Bid is in the possession of the responsible official or his designated alternate prior to the stated time and at the stated place of the bid opening. Owner is not responsible for Bids delayed by mail or delivery services of any nature.

**CONFLICT OR INCONSISTENCIES:** Bidders are also cautioned that if more than one set of conditions are included in the contract, then in case of a conflict between any of the conditions the strictest will apply.

**BID SUBMISSION REQUIREMENTS:** Bids shall be submitted at the time and place indicated in the Advertisement or Invitation to Bid and shall be enclosed in an opaque sealed envelope, marked with the project title (and if applicable, the designated portion of the Project for which the Bid is submitted) and name, address of the Bidder and accompanied by the bid bond and other required documents. If the bid is sent through the mail or other delivery system the sealed envelope shall be enclosed in a separate envelope with notation “Bid Enclosed” on the face of it.

(End Information for Bidders)
TO: North Charleston Sewer District Purchasing Department
PO Box 63009
North Charleston, SC 29419

FROM: ____________________________________
____________________________________
____________________________________

of the City of___________________, County of_________________, and State of________________________, hereinafter called “Bidder”.

PROJECT: NCSD SEPTAGE STATION

Gentlemen:

The Bidder, in compliance with your Advertisement or Invitation for Bids for the construction of above-referenced project, having examined the Specifications with related documents and the site of the proposed work, and being familiar with all of the conditions surrounding the construction of the proposed project, including the availability of materials and labor, hereby proposes to furnish all labor, materials, and supplies, and to construct the project in accordance with the Contract Documents, within the time set forth therein, and the prices stated below. These prices are to cover all expenses incurred in performing the work required under the Contract Documents, of which this proposal is a part.

The Bidder declares that he has carefully examined the site of the proposed Work and fully informed and satisfied himself as to the conditions there existing, the character and requirements of the proposed Work, and the difficulties attendant upon its execution, and that he has carefully read and examined the Drawings, and the Specifications and other Contract Documents therein referred to, and knows and understands the terms and provisions thereof.

Bidder understands that information relative to existing structures, apparent and latent conditions, and natural phenomena, as furnished to him on the Drawings, in the Contract Documents, or by the Owner or the Engineer, carries no guarantee expressed or implied as to its completeness or accuracy, and he has made due allowance therefore.

TIME FOR COMPLETION AND LIQUIDATED DAMAGES: Bidder hereby agrees to commence work under this contract within 15 days of receipt of the Notice to Proceed and to fully complete the project within 180 consecutive calendar days thereafter.
Bidder also agrees to pay $500/day as liquidated damages for each consecutive calendar day thereafter as hereinafter provided in the General Conditions.

ADDENDA: Bidder acknowledges receipt of the following Addenda:

Addendum No.__________ Date__________
Addendum No.__________ Date__________
Addendum No.__________ Date__________
Addendum No.__________ Date__________

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Extended Price</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>Septage Station (Inc. sales tax)</td>
<td>1</td>
<td>LS</td>
<td></td>
<td></td>
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<tr>
<td>2.</td>
<td>Wetwell Pump and Control Panel (inc. sales tax)</td>
<td>1</td>
<td>LS</td>
<td></td>
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</tr>
<tr>
<td>3.</td>
<td>Construct, install and startup of a fully functioning septage receiving station as shown on the construction plans and project specifications</td>
<td>1</td>
<td>LS</td>
<td></td>
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<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td>TOTAL</td>
</tr>
</tbody>
</table>

NOTE: ALL QUANTITIES ARE APPROXIMATE.

TOTAL BASE BID (ITEMS 1-9, INCLUSIVE) $____________________

Additions to work and deletions from work shall be paid in accordance with these unit prices.

The above unit prices shall include all labor, materials, dewatering, shoring, removal, overhead, profit, insurance, taxes, fees, etc., to cover the finished work of the several kinds called for. Bidder understands that the Owner reserves the right to reject any or all bids and to waive any informality in the bidding.

The Bidder agrees that this Bid shall be good and may not withdraw for a period of 90 calendar days after the scheduled closed time for receiving bids.

Upon receipt of written notice of the acceptance of this Bid, Bidder will execute the formal Agreement attached with 10 days, and deliver Surety bonds as required by the General Conditions. The bid security attached in the sum of ___________________ ($_____________________) is to become the property of the Owner in the event the Agreement and Bond are not executed within the time above set forth as liquidated damages for the delay and additional expense to the Owner caused thereby.
The undersigned declares that the person or persons signing this proposal is fully authorized to sign the proposal on behalf of the firm listed and to fully bind the firm listed to all the conditions and provisions thereof.

It is agreed that no person or persons or company other than the firm listed below or as otherwise indicated hereinafter has any interest whatsoever in this proposal or the contract that may be entered into as a result thereof, and that in all respects the proposal is legal and fair, submitted in good faith, without collusion or fraud.

Respectfully Submitted:

____________________________________
Contractor

By:_________________________________

____________________________________
(Title)

____________________________________
(Address)

SC General Contractor’s License No.________________________  (End Bid)
BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _______________ as Principal, and _______________ as Surety, are hereby held and firmly bound unto the North Charleston Sewer District as OWNER in the penal sum of 5% (five percent) of BID for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

Signed, this ______ day of ________________, 20______.

The Condition of the above obligation is such that whereas the Principal has submitted to the North Charleston Sewer District a certain BID, attached hereto made a part hereof to enter into a contract in writing, for the NCSD SEPTAGE STATION Documents dated _____________, by the Owner.

NOW THEREFORE, (a) If said BID shall be rejected, or (b) If said BID shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said BID) and shall furnish a BOND for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said BID, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulated and agrees that the obligations of said Surety and its BOND shall be in no way impaired or affected by an extension of the time within which the OWNER may accept such BID; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

_____________________________________ (LS)  _______________ (LS)

(Principal)  Surety

By: ________________________________

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

THIS AGREEMENT, made this ____ day of _______________, 20______, by and between North Charleston Sewer District acting herein through its ________________ Purchasing Manager __________________________ (Kimberly J Caver) hereinafter called “OWNER” and __________________________

(Name of Contractor) doing business as __________________________

(an Individual),(a Partnership) or (a Corporation) of the City of __________________________ County of __________________________ and State of __________________________ hereinafter called “Contractor.”

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned:

1. The CONTRACTOR hereby agrees with the OWNER to commence and complete the construction described as follows:
   NCSD SEPTAGE STATION hereinafter called the PROJECT.

2. The CONTRACTOR will furnish all of the materials, supplies, tools, equipment, labor, and other services necessary for the construction and completion of the PROJECT described herein.

3. The CONTRACTOR will commence the work required by the CONTRACT DOCUMENTS within 15 calendar days after the date of the NOTICE TO PROCEED and will fully complete the PROJECT within 180 consecutive calendar days unless the period for completion is extended otherwise by the CONTRACT DOCUMENTS. The CONTRACTOR further agrees to pay, as liquidated damages, the sum of $500 for each consecutive calendar day thereafter as hereinafter provided in the GENERAL CONDITIONS.

4. The CONTRACTOR agrees to perform all of the WORK described in the CONTRACT DOCUMENTS and comply with the terms therein for the sum of ________________ ________________ Dollars ($__________) or as shown in the Bid Schedule.

5. The term “CONTRACT DOCUMENTS” means and includes the following:
   A. Advertisement for Bids
B. Information for Bidders
C. Bid
D. Bid Bond
E. Agreement
F. General Conditions
G. Supplemental Conditions
H. Performance Bond
I. Payment Bond
J. Notice of Award
K. Notice to Proceed
L. Change Orders
M. Specifications prepared by North Charleston Sewer District
N. Addenda
   No. _____ Dated __________________________
   No. _____ Dated __________________________
   No. _____ Dated __________________________
   No. _____ Dated __________________________

6.   The OWNER agrees to pay the CONTRACTOR in the manner and at such time as set forth in the General Conditions such amounts as required by the CONTRACT DOCUMENTS.

7.   The Agreement shall be binding on all parties hereto and their respective heirs, executors, administrators, successors and assigns.

IN WITNESS WHEREOF, the parties hereto have executed or caused to be executed by their duly authorized officials, this Agreement in four counterparts, each of which shall be deemed an original, in the year and day first above written.

______________________________
(Owner)

By: ______________________________

ATTEST: ________________________________
        (Title of Authorized Official)

______________________________
(Witness)

______________________________
(Witness)
(Contractor)

By: ________________________________

(Name)

_______________________________

(Title)

_______________________________

(Address)

ATTEST:

_______________________________

(Witness)

_______________________________

(Witness)

(End of Agreement Section)
CERTIFICATE OF ACKNOWLEDGMENT OF CONTRACTOR IF A CORPORATION
FOR AGREEMENT

STATE OF ___________________________
COUNTY OF ___________________________

ON THIS ______ day of ____________, 20___, before me

personally came__________________________, to me known, who

being by me duly sworn, did depose and say as follows:

that he resides at ____________________________

and is the ______________________ of _______________________

(Title of Officer) (Name of Corporation)

the Corporation described in and which executed the foregoing instrument; that he knows the corporate seal of said Corporation; that the seal affixed to the foregoing instrument is such Corporate Seal and it was so affixed by order of the Board of Directors of said Corporation; and that by the like order he signed thereto his name and official designation.

By: ____________________________

(Name)

______________________________

(Title)

Notary Public (Seal)

My Commission expires: ____________________________
PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)
a ________________________________, hereinafter called Principal and
(Corporation, Partnership or Individual)

(Name of Surety)

(Address of Surety)
Hereinafter called Surety, are held and firmly bound unto

NORTH CHARLESTON SEWER DISTRICT
(Name of Owner)

7225 STALL ROAD, NORTH CHARLESTON, SC  29406
(Address of Owner)

Hereinafter called OWNER, in the penal sum of ________________________________ Dollars, ($_________) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents. THE CONDITION OF THIS OBLIGATION is such that whereas the Principal entered into a certain contract with the OWNER, dated the _____ day of ______, 20___, a copy of which is hereto attached and made a part hereof for the NCSD SEPTAGE STATION.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements, of said contract during the original term thereof, and any extensions thereof which may be granted by the OWNER, with or without notice to the Surety and during the two year guaranty period, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the WORK to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any wise affect its obligation of time, alteration, or addition to the terms of the contract or to the WORK or
to the SPECIFICATIONS. PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in four (4) counterparts, each one of which shall be deemed an original, this the ______ day of ____________, 20 _______.

(Principal)

ATTEST:

(Principal) Secretary (SEAL)

By: ____________________________ (S)

Address

Witness to Principal

Address

WITNESS:

(Surety) By: ____________________________ Attorney-in-Fact

(SERIAL)

Address

Witness as to Surety

Address

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

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

KNOW ALL MEN BY THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)

a__________________________, hereinafter called Principal and
(Corporation, Partnership or Individual)

(Name of Surety)

(Address of Surety)

Hereinafter called Surety, are held and firmly bound unto

NORTH CHARLESTON SEWER DISTRICT
(Name of Owner)

7225 STALL ROAD, NORTH CHARLESTON, SC  29406
(Address of Owner)

Hereinafter called OWNER, in the penal sum of _______________ Dollars, $(______) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.  THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the Owner, dated the   day of   , 20__, a copy of which is hereto attached and made a part hereof for **NCSD SEPTAGE STATION**.

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, SUBCONTRACTORS, and corporations furnishing materials for or performing labor in the prosecution of the WORK provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such WORK whether by SUBCONTRACTOR or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

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

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

IN WITNESS WHEREOF, this instrument is executed in four (4) counterparts, each one of which shall be deemed an original, this the _______ day of ____________________, 20___.

ATTEST: ________________________________

Principal

______________________________

(Principal) Secretary (SEAL)

By: ________________________________ (S)

______________________________

Address

Witness to Principal

______________________________

Address

WITNESS:

______________________________

Surety

______________________________

By: ________________________________

Attorney-in-Fact

______________________________

(S surety)

(SEAL)

______________________________

Address

Witness as to Surety

______________________________

Address

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

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department’s most current list (Circular 570 as amended) and authorized to transact business in the State where the PROJECT is located.
CERTIFICATE OF ACKNOWLEDGMENT OF CONTRACTOR IF A CORPORATION
FOR CONTRACT BONDS

STATE OF )

) SS:

COUNTY OF )

ON THIS ___ day of ________________, 20__, before me personally came

__________________________, to me known, who being by me duly sworn, did depose

and say as follows:

that he resides at _______________________________________________________

and is the ____________ of ____________________________________________

(Title of Officer) (Name of Corporation)

the Corporation described in and which executed the foregoing instrument; that he knows the
corporate seal of said Corporation; that the seal affixed to the foregoing instrument is such
Corporate Seal and it was so affixed by order of the Board of Directors of said Corporation; and
that by the like order he signed thereto his name and official designation.

By: ______________________

(Name)

________________________

(Title)

Notary Public (SEAL)

My Commission expires: ________________
CERTIFICATION

Any person signing documents under CERTIFICATE OF ACKNOWLEDGMENT OF CONTRACTOR IF A CORPORATION FOR CONTRACT BONDS section shall also make the following certification:

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

Date of Signature _____________________________

Signature ____________________________________

Title________________________________________

Name of Firm_________________________________

Address_______________________________________

________________________________________________________________________

Telephone No. _________________________________
NOTICE OF AWARD

TO: ___________________________ Date: ___________________________

PROJECT DESCRIPTION: NCSD SEPTAGE STATION

The OWNER has considered the BID submitted by you for the above described WORK in response to its Advertisement or Invitation for Bids dated _____________, 20___, and Information for Bidders.

You are hereby notified that your BID has been accepted for items in the amount of $___________.

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

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

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

Dated this ___ day of ____________, 20__.

Owner
By: ___________________________
Title: ___________________________

ACCEPTANCE OF NOTICE

Receipt of the NOTICE OF AWARD is hereby acknowledged by _______________________
this the _____ day of _________________, 20__.

By: ___________________________
Title: ___________________________
NOTICE TO PROCEED

TO: ___________________________ Date: ___________________________

Project: **NCSD SEPTAGE STATION**

You are hereby notified to commence WORK in accordance with the Agreement dated __________________, 20__, on or before __________________, 20__, and you are to complete the WORK within ______ consecutive calendar days thereafter. The date of completion of all WORK is therefore __________________, 20__.

Owner

By: ___________________________

Title: __________________________

ACCEPTANCE OF NOTICE

Receipt of the NOTICE OF AWARD is hereby acknowledged by ___________________________ this the _____ day of ______________, 20__.

By: ___________________________

Title: __________________________
CHANGE ORDER

Order No.: _______ Date: ________________
Agreement Date:
NAME OF PROJECT: NCSD SEPTAGE STATION
OWNER: ____________________________
CONTRACTOR: _______________________
The following changes are hereby made to the CONTRACT DOCUMENTS:
Justification:

Change to CONTRACT PRICE: $______.
Original CONTRACT PRICE: $______.
Current CONTRACTOR PRICE adjusted by previous CHANGE ORDER: $______
The CONTRACT PRICE due to this CHANGE ORDER will be (increased) (decreased) by:
$___________.

Change to CONTRACT TIME:

The CONTRACT TIME will be (increased) (decreased) by _______calendar days.

The date for completion of all work will be ________________________
(Date)

Approvals Required:
To be effective this Order must be approved by the State agency if it changes the scope or objective of the PROJECT.

ENGINEER: ________________________ OWNER: ________________________
North Charleston Sewer District: ________________________
CONTRACTOR: ________________________
REQUEST FOR PAYMENT

CONTRACTOR: 

ENGINEER: 

REQUEST FOR PAYMENT

DATE: ______________________
MONTHLY PAYMENT NO. 

TO: ______________________

LOCATION: ______________________

PROJECT: **NCSD SEPTAGE STATION**

FOR PERIOD ________________ TO ________________

TOTAL VALUE OF WORK COMPLETED TO DATE 
(SEE ATTACHED SHEETS) $_______________

TOTAL VALUE MATERIALS STORED FOR PROJECT 
(SEE ATTACHED SHEETS) $_______________

SUB-TOTAL $_______________

DEDUCTIONS: ___________LESS ______%RETAINED $_______________

LESS PREVIOUS PAYMENTS $_______________

TOTAL AMOUNT THIS PAYMENT $_______________

PREVIOUS PAYMENTS

1. __________ 4. __________ 7. __________ 10. __________
2. __________ 5. __________ 8. __________ 11. __________
3. __________ 6. __________ 9. __________ 12. __________
CONTRACTOR’S CERTIFICATION:

I HEREBY CERTIFY THE ABOVE WORK PERFORMED AND MATERIALS STORED ON PROJECT ARE AS PER THE PROVISIONS OF THE CONTRACT AGREEMENT.

CONTRACTOR
BY: ____________________
DATE: ________________

APPROVED FOR ENGINEER
BY: ____________________
DATE: ________________

APPROVED FOR OWNER
BY: ____________________
DATE: ________________

APPROVED FOR ADMINISTRATOR
BY: ____________________
DATE: ________________
GENERAL CONDITIONS

1.0 GENERAL

1.1 THE CONTRACT DOCUMENTS: The Contract Documents consists of the Advertisement of Bids, Information for Bidders, Bid, Bid Bond, Agreement, Payment Bond, Performance Bond, Conditions of the Contract (General, Supplemental and Other Conditions), Drawings, Specifications, Addenda, Notice of Award, Notice to Proceed, and Change Orders.

1.2 CORRELATION AND INTENT OF DOCUMENTS: The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all.

The intent of the Drawings and Specifications is to provide a complete and usable facility. The Contractor’s work shall be based on the Drawings and Specifications, but the Contractor shall furnish all labor, supplies, materials, tools, machinery, equipment, transportation, supervision, temporary construction of any nature, and all other services, facilities and means necessary to produce a complete and workable facility whether or not such material and appurtenances are shown on the Drawings or described in the Specifications.

Any mention in the Specifications or indication on the Drawings of articles, materials, methods or operations shall require the Contractor to furnish such item or services as if it were fully specified unless it is noted or specified as not in the Contract. It is intended that all materials shall be new and best quality in every respect unless otherwise noted or specified. All workmanship, methods of assembly, and erection shall be first class in every respect.

1.3 CONFLICT OR INCONSISTENCY: If there is any conflict or inconsistency between the provisions of the Supplemental Conditions and the provisions of the other Contract Documents, the provisions of the Supplemental Conditions shall prevail. If there is any conflict or inconsistency between the provisions of the General Conditions and the provisions of any of the Contract Documents, other than the Supplemental Conditions, the provisions of the General Conditions shall prevail.

In case of conflict the Drawings and Specifications, the Specifications shall govern. Figure dimensions on Drawings shall govern over scale dimensions, and detailed Drawings shall govern over general Drawings.

In case of difference between small-scale and large-scale drawings, the large scale drawings shall govern. Schedules on any contract drawing shall take precedence over conflicting information on that or any other contract drawing.

On any of the drawings where a portion of the work is detailed or drawn out and the remainder is shown in outline, the parts detailed or drawn out shall apply also to all other like portions of the work. Where the word “similar” occurs on the drawings, it shall have a general meaning and not be interpreted as being identical, and all details shall be worked out in relation to their location and their connection with other parts of the work.
Any discrepancies found between the Drawings and Specifications and site conditions or any inconsistencies or ambiguities in the Drawings or Specifications shall be immediately reported to the Engineer, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. Work done by the Contractor after his discovery of such discrepancies, inconsistencies or ambiguities shall be done at the Contractor’s risk.

Should a conflict be discovered within the Contract Documents, the Contractor shall be deemed to have estimated the higher quality way of doing the Work unless he shall have asked for and obtained a decision in writing from the Engineer before entering into this Contract.

1.4 ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS: The contractor may be furnished additional instructions and detail drawings, by the Engineer, as necessary to carry out the Work required by the Contract Documents. The additional drawings and instructions thus supplied will become a part of the Contract Documents. The Contractor shall carry out the Work in accordance with the additional detail drawings and instructions.

1.5 SPECIFICATION HEADINGS: For convenience of reference, these Specifications are divided into various divisions, Sections, subsections and Paragraphs, The titles of these headings shall not be taken as a correct or complete segregation of the various types of material and labor nor as an attempt to outline jurisdictional procedures. The headings shall not be deemed to limit or restrict the content, meaning or effect of such section, subsection, paragraph, provision or part.

The organization of the Specifications into the various headings, and the arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Each subcontract shall be dependent upon its own definite confines, regardless of Divisions of these Specifications. No responsibility, either direct or implied, is assumed by the Owner for omissions or duplications by the Contractor or by any of his subcontractors due to real or alleged errors in arrangement of matter in Contract Documents.

1.6 DRAWINGS AND SPECIFICATIONS FOR CONSTRUCTION PURPOSES: The Contractor will be furnished four (4) complete sets of Drawings and Specifications to be used during the course of construction. If more than four (4) sets are needed, the Contractor will be required to pay the actual cost of printing and handling.

1.7 CONTRACT MODIFICATION: All changes which affect the cost of the construction of the Project must be authorized by means of a contract change order. All change orders and contract modifications must be approved by the Owner prior to becoming effective. The contract change order will include extra work, work for which quantities have been altered from those shown in the bidding schedule as well as decreases or increases in the quantities of installed units which are different from those shown in the bidding schedule because of final measurements. All changes should be recorded on a contract change order as they occur so that they may be included in the partial payment estimate.

1.8 COMPUTATION OF QUANTITIES: For estimating quantities in which the computation of areas by geometric methods would be comparatively laborious, it is agreed that the planimeter shall be considered an instrument of precision adapted to the measurement of such areas. It is
further agreed that the computation of the volume of prismoids shall be by the method of average end areas.

1.9 SIGNS: The Owner reserves the right to all advertising privileges about the job and no signs shall be posted by the Contractor anywhere on the premises without approval by the Owner except those signs, posters, or bulletins required by Federal, State, or local authorities. Directional signs identifying offices and/or storage areas of the Contractor may be erected as required to facilitate work, provided:

1. The Contractor shall submit to the Owner for approval a scale drawing or sketch of the proposed sign showing size, type of material, painting, and proposed location. All submittal data shall be in triplicate.

2. The size of the individual sign shall be not greater than 24 inches wide by 12 inches high.

3. Signs shall be neatly painted on weather-resistant materials.

4. The signs will be removed upon completion of the job.

5. No sign shall be erected prior to approval by the Owner.

1.10 PUBLICITY: All prime contractors and their subcontractors shall submit to the Owner for approval all publicity items, including photographs, relating to the work of this project. Owner shall approve any and all material prior to release for publication.

1.11 DEFINITIONS: Wherever the words hereinafter defined or pronouns used in their stead occur in the Contract Documents, they shall have the following meanings:

ADDENDA: Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the Contract Document, Drawings and Specifications by additions, deletions, clarifications or corrections. Such addendum or addenda will take precedent over the position of the general drawings and specifications concerned and will be considered as part of the Contract Documents.

AGREEMENT: The Agreement represents the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations or agreements, either written or oral, including the bidding documents. The Agreement may be amended or modified by a Change Order.

BID: The written offer or proposal of the Bidder, submitted on the prescribed form, properly signed and guaranteed, to perform the work at the prices quoted by the Bidder.

BID BOND: The security furnished by the Bidder with his proposal for the Project is guaranty he will enter into a contract for the work if his proposal is accepted.

BIDDER: Any individual, firm or corporation or combination of same submitting a
bid for work contemplated, acting directly or through a duly authorized representative.

BONDS: Bid, Performance and Payment Bonds and other instruments of security furnished by the Contractor and his Surety in accordance with the Contract Documents.

CALENDAR DAY: Every day shown on the calendar, Sundays and holidays included.

CHANGE ORDER: A written order to the Contractor authorizing an addition, deletion or revision in the Work within the general scope of the Contract Documents, or authorizing an adjustment in the Contract Price or Contract Time.

CONTRACT: The Contract Documents form the Contract. The Contract represents the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations or agreements, either written or oral, including the bidding documents. The Contract may be amended or modified by a Change Order.

CONTRACT DOCUMENTS: The Contract Documents consist of the Advertisement for Bids, Information for Bidders, Bid, bid Bond, Agreement, Payment Bond, Performance Bond, the Conditions of the Contract (General, Supplemental, and other Conditions), the Drawings, the Specifications, Addenda issued prior to execution of the Contract, Notice of Award, Notice to Proceed, Change Orders and Supplemental Conditions.

CONTRACT PRICE: The total moneys payable to the Contractor under the terms and conditions of the Contract Documents.

CONTRACTOR: The individual, firm or corporation with whom the Owner has executed the Agreement by which the Contractor is obligated directly, or through Subcontractors, to perform work in connection with the Project.

The Contractor is the person or organization identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number and masculine in gender. The term Contractor means the Contractor or his authorized representative.

CONTRACT TIME: The number of calendar days stated in the Contract Documents for the completion of the Work.

DRAWINGS: The part of the Contract Documents which show the characteristics and scope of the Work to be performed and which have been prepared or approved by the Engineer.

EARTH: An excavated material or material to be excavated; all kinds of material other than rock.

ELEVATION: The figures given on the Drawings or in the other Contract
Documents after the work “elevation” or abbreviation of it shall mean the distance in feet above the datum adopted by the Engineer.

ENGINEER: The person, firm or corporation named as such in the Contract Documents and duly appointed by the Owner to undertake the duties and powers herein assigned to the Engineer, acting either directly or through duly authorized representatives.

EQUIPMENT: All machinery, together with the necessary supplies for upkeep and maintenance, and all tools and apparatus necessary for the proper construction and acceptable completion of the work.

FIELD ORDER: A written order effecting a change in the Work not involving an adjustment in the Contract Price or an extension of the Contract Time, issued by the Engineer to the Contractor during construction.

FURNISH: Furnish and install complete, in place, and ready for use.

INFORMATION FOR BIDDERS: The Notice to Contractors containing all necessary information as to provisions, requirements, date, place, and time of submitting bids.

INCLEMENT WEATHER: Weather affecting the work area severe enough to warrant cessation of all work activities. This includes heavy rain, hail, hurricane, earthquake, freezing rain, heavy fog, tornado, or any other weather condition for which a weather alert, warning or watch is issued, and which affects the project area. Additional time may be afforded for inclement weather.

MATERIALS: Any substance specified for use in the construction of the Project and its appurtenances.

NET COST: The cost to the Contractor after application of all credits and discounts (excepting only cash discounts) and without the addition of any factor for burden, overhead or indirect cost or profit.

NOTICE OF AWARD: The written notice of the acceptance of the Bid from the Owner to the successful Bidder.

NOTICE TO PROCEED: Written communication issued by the Owner to the Contractor authorizing him to proceed with the Work and establishing the date of commencement of the Work.

OPTIMUM MOISTURE CONTENT FOR COMPACTION: The moisture content of a soil calculated on the basis of dry weight of soil at which the soil can be compacted to the approximate density under a specified standard method of compaction.
OWNER: A public or quasi-public body or authority, corporation, association, partnership, or individual for whom the Work is to be performed.

PAYMENT BOND: The approved of security furnished by the Contractor to guarantee the payment to all persons supplying labor and materials in the prosecution of the work in accordance with the terms of the Contract.

PERFORMANCE BOND: The approved form of security furnished by the Contractor to guarantee the completion of the work in accordance with the terms of the Contract.

PRECONSTRUCTION CONFERENCE: A conference following award and prior to start of construction to be attended by a duly authorized representative of the Engineer and by the responsible officials of the Contractor and other affected parties.

PROJECT: The understanding to be performed as provided in the Contract Documents.

PROPOSAL: The written offer of the Bidder, submitted on the prescribed form, properly signed and guaranteed, to perform the work at the prices quoted by the Bidder.

PROPOSAL FORM: The approved form on which the Owner requires formal bids to be prepared and submitted for the work.

PROPOSAL GUARANTY: The security furnished by the Bidder with his proposal for a Project, as guaranty he will enter into a contract for the work if his proposal is accepted.

PROVIDE: Furnish and install complete, in place, and ready for use.

RESIDENT PROJECT REPRESENTATIVE: The authorized representative of the Owner who is assigned to the Project site or any part thereof.

ROCK: An excavated material or material to be excavated; only boulders and pieces of concrete or masonry exceeding ½ cu. yd. in volume, or solid ledge rock which, in the opinion of the Engineer, requires, for its removal, drilling and blasting, wedging, sledging, barring, or breaking up with a power-operated tool. No soft or disintegrate rock which can be removed with hand pick or power-operated excavator or shovel, no loose shaken, or previously blasted rock or broken stone in rock fillings or elsewhere, and no rock exterior to the maximum limits of measurement allowed, which may fall into the excavation will be classified as rock.

SHOP DRAWINGS: All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the Contractor, a Subcontractor, manufacturer, Supplier or distributor, which illustrate how specific portions of the Work shall be fabricated or installed.
SPECIALIST: An individual or firm of established reputation which is regularly engaged in, and which maintains a regular force of workmen skilled in either manufacturing or fabricating items required items required by the Contract, installing items required by the Contract, or otherwise performing work required by the Contract. Where the contract specifications require installation by a specialist, that term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer’s direct supervision.

STRUCTURES: Bridges, culverts, catch basis, drop inlets, manholes, retaining walls, cribbing, endwalls, buildings, sewers, service pipes, under drains, foundation drains, and other miscellaneous items which may be encountered in the work, and which are not otherwise classified herein.

SUBBASE: The layer or layers of specified or selected material of designated thickness or rate of application placed on a sub grate to comprise a component of the pavement structure to support the base course, pavement or subsequent layer of the construction.

SUBCONTRACTOR: An individual, firm or corporation having a direct contract with the Contractor or with any other Subcontractor for the performance of a apart of the Work at the site. The term subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Subcontractor or his authorized representative.

SUB-SUBCONTRACTOR: An individual, firm or corporation having a direct or indirect contract with Subcontractor to perform any of the Work at the site. The term Sub-subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Sub-subcontractor or an authorized representative thereof.

SUBGRADE: The top surface of a roadbed upon which the pavement structure and shoulders are constructed.

SUBSTANTIAL COMPLETION: That date as certified by the Engineer when the construction of the Project or a specified part thereof is sufficiently completed, in accordance with the Contract Documents, so that the Project or specified part can be utilized for the purposes for which it is intended.

SUPPLEMENTAL CONDITIONS: Conditions of that Contract other than the General Conditions.

SUPERINTENDENT: The Contractor’s authorized representative in responsible charge of the Work.
SUPPLIER: Any person or organization who supplies materials or equipment for the Work, including that fabricated to a special design, but who does not perform labor at the site.

SURETY: The corporation, partnership or individual bound with and for the Contractor for the full and complete performance of the Contract, and for the payment of all debts pertaining to the Work.

TITLES (OR HEADINGS): The titles or headings of the sections and subsections herein are intended for convenience of reference and shall not be considered as having any bearing on their interpretation.

WORK: All labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in the Project.

WRITTEN NOTICE: Any notice to any part of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address, or delivered in person to said party or his authorized representative on the Work.

1.12 ADDITIONAL DEFINITIONS: Wherever in the Specifications or on the Drawings, the words, “as designated”, “as detailed”, “as detailed”, “as directed”, “as ordered”, “as permitted”, “as prescribed”, “as provided”, “as requested”, “as required”, or words of like import are used, it shall be understood that the designation, detail, direction, order, permission, prescription, provision, request or requirement of the Engineer is intended.

Similarly, the words “approved”, “acceptable”, “satisfactory”, and words of like import shall mean approved by, acceptable to, or satisfactory to the Engineer.

1.13 ABBREVIATIONS: Where any of the following abbreviations are used in the Specifications, they shall have the meaning set forth opposite each.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>Aluminum Association</td>
</tr>
<tr>
<td>AWWA</td>
<td>American Water Works Association</td>
</tr>
<tr>
<td>AAMA</td>
<td>Architectural Aluminum Manufacturers Association</td>
</tr>
<tr>
<td>BHMA</td>
<td>Builders Hardware Manufacturers Association</td>
</tr>
<tr>
<td>AAN</td>
<td>American Association of Nurserymen</td>
</tr>
<tr>
<td>CABRA</td>
<td>Copper and Brass Research Association</td>
</tr>
<tr>
<td>AAR</td>
<td>Association of American Railroads</td>
</tr>
<tr>
<td>CDA</td>
<td>Copper Development Association</td>
</tr>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
</tr>
<tr>
<td>CEMA</td>
<td>Conveyor Equipment Manufacturers Association</td>
</tr>
<tr>
<td>AATC</td>
<td>American Association of Textile Chemists and Colorists</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
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<td>---------</td>
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</tr>
<tr>
<td>CGA</td>
<td>Compressed Gas Association</td>
</tr>
<tr>
<td>CRSI</td>
<td>Concrete Reinforcing Steel Institute</td>
</tr>
<tr>
<td>ACI</td>
<td>American Concrete Institute</td>
</tr>
<tr>
<td>CS</td>
<td>Commercial Standards, U.S. Department of Commerce</td>
</tr>
<tr>
<td>ACPA</td>
<td>American Concrete Pipe Association</td>
</tr>
<tr>
<td>AED</td>
<td>American Equipment Dealers</td>
</tr>
<tr>
<td>CSI</td>
<td>Construction Specification Institute</td>
</tr>
<tr>
<td>AFBMA</td>
<td>Anti-Friction Bearing Manufacturers Association</td>
</tr>
<tr>
<td>DCDMA</td>
<td>Diamond Core Drill Manufacturers Association, Inc.</td>
</tr>
<tr>
<td>AFI</td>
<td>American Filter Institute</td>
</tr>
<tr>
<td>EIA</td>
<td>Electronic Industries Association</td>
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<tr>
<td>AGA</td>
<td>American Gas Association</td>
</tr>
<tr>
<td>FCI</td>
<td>Fluid Controls Institute</td>
</tr>
<tr>
<td>AGC</td>
<td>Associated General Contractors</td>
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<tr>
<td>FGIA</td>
<td>Flat Glass Jobbers Association</td>
</tr>
<tr>
<td>AGMA</td>
<td>American Gear Manufacturers Association</td>
</tr>
<tr>
<td>FIA</td>
<td>Factory Insurance Association</td>
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<tr>
<td>AHAM</td>
<td>Association of Home Appliance Manufacturers</td>
</tr>
<tr>
<td>FM</td>
<td>Factory Manual</td>
</tr>
<tr>
<td>FMEC</td>
<td>Factory Mutual Engineering Corporation</td>
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<tr>
<td>AHDGA</td>
<td>American Hot Dip Galvanizers Association</td>
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<tr>
<td>FS</td>
<td>Federal Specification</td>
</tr>
<tr>
<td>AIA</td>
<td>American Institute of Architects</td>
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<tr>
<td>FSPT</td>
<td>Federation of Societies for Paint Technology</td>
</tr>
<tr>
<td>AIEE</td>
<td>American Institute of Electrical Engineers</td>
</tr>
<tr>
<td>AISC</td>
<td>American Institute of Steel Construction</td>
</tr>
<tr>
<td>FSS</td>
<td>Federal Specifications, General Services Adminstration</td>
</tr>
<tr>
<td>AISI</td>
<td>American Iron and Steel Institute</td>
</tr>
<tr>
<td>ALS</td>
<td>American Lumber Standards</td>
</tr>
<tr>
<td>FHWA</td>
<td>Federal Highway Administration</td>
</tr>
<tr>
<td>AMA</td>
<td>Acoustical Materials Association</td>
</tr>
<tr>
<td>GA</td>
<td>Gypsum Association</td>
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<tr>
<td>AMCA</td>
<td>Air Moving and Conditioning Association</td>
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<tr>
<td>IBI</td>
<td>Insulation Board Institute</td>
</tr>
<tr>
<td>ANS</td>
<td>American Nuclear Society</td>
</tr>
<tr>
<td>IBR</td>
<td>Institute of Boiler and Radiator Manufacturers</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>APA</td>
<td>American Plywood Association</td>
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<tr>
<td>IEEE</td>
<td>Institute of Electric and Electronics Engineers</td>
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<tr>
<td>API</td>
<td>American Petroleum Institute</td>
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<tr>
<td>ARA</td>
<td>American Railway Association</td>
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<tr>
<td>IES</td>
<td>Illuminating Engineering Society</td>
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<tr>
<td>AREA</td>
<td>American Railway Engineering Association</td>
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<tr>
<td>ILIA</td>
<td>Indiana Limestone Institute of America</td>
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<tr>
<td>ARI</td>
<td>Air Conditioning and Refrigeration Institute</td>
</tr>
<tr>
<td>IME</td>
<td>Institute of Makers of Explosives</td>
</tr>
<tr>
<td>Acronym</td>
<td>Organization Name</td>
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</tr>
<tr>
<td>ASA</td>
<td>Acoustical Society of America</td>
</tr>
<tr>
<td>IP</td>
<td>Institute of Petroleum (London)</td>
</tr>
<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
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<tr>
<td>IPC</td>
<td>Institute of Printed Circuits</td>
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<tr>
<td>ASHRAE</td>
<td>American Society of Heating and Refrigerating Air Conditioning Engineers</td>
</tr>
<tr>
<td>IPCEA</td>
<td>Insulated Power Cable Engineers Association</td>
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<tr>
<td>ASLA</td>
<td>American Society of Landscape Architects</td>
</tr>
<tr>
<td>ISA</td>
<td>Instrument Society of America</td>
</tr>
<tr>
<td>ASLE</td>
<td>American Society of Lubricating Engineers</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
</tr>
<tr>
<td>ASQC</td>
<td>American Society for Quality Control</td>
</tr>
<tr>
<td>ITE</td>
<td>Institute of Traffic Engineers</td>
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<td>ASSE</td>
<td>American Society of Sanitary Engineers</td>
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<td>LIA</td>
<td>Lead Industries Association</td>
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<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
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<tr>
<td>MBMA</td>
<td>Metal Building Manufacturers Association</td>
</tr>
<tr>
<td>AVATI</td>
<td>Asphalt and Vinyl Asbestos Tile Institute</td>
</tr>
<tr>
<td>MIA</td>
<td>Marble Institute of America</td>
</tr>
<tr>
<td>AWI</td>
<td>Architectural Woodwork Institute</td>
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<tr>
<td>MLA</td>
<td>Metal Lath Association</td>
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<tr>
<td>AWPA</td>
<td>American Wood Preservers’ Association</td>
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<tr>
<td>MLMA</td>
<td>Metal Lath Manufacturers Association</td>
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<td>AWPI</td>
<td>American Wood Preservers’ Institute</td>
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<td>MPTA</td>
<td>Mechanical Power Transmission Association</td>
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<td>AWS</td>
<td>American Welding Society</td>
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<td>MRIS</td>
<td>Maritime Research Information Service</td>
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<tr>
<td>PDCA</td>
<td>Painting and Decorating Council of America</td>
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<tr>
<td>MS</td>
<td>Military Specification</td>
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<tr>
<td>MSTD</td>
<td>Military Standard</td>
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<td>PEI</td>
<td>Porcelain Enamel Institute</td>
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<td>NAAMM</td>
<td>National Association of Architectural Metal Manufacturers</td>
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<tr>
<td>PI</td>
<td>Perlite Institute</td>
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<td>RIS</td>
<td>Redwood Inspection Service</td>
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<td>NAFM</td>
<td>National Association of Fan Manufacturers</td>
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<tr>
<td>RMA</td>
<td>Rubber Manufacturers Association</td>
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<tr>
<td>NBFU</td>
<td>National Board of Fire Underwriters</td>
</tr>
<tr>
<td>RTI</td>
<td>Resilient Tile Institute</td>
</tr>
<tr>
<td>NBS</td>
<td>National Bureau of Standards</td>
</tr>
<tr>
<td>RWMA</td>
<td>Resistance Welder Manufacturers Association</td>
</tr>
<tr>
<td>NCCLS</td>
<td>National Committee for Clinical Laboratory Standards</td>
</tr>
<tr>
<td>SAE</td>
<td>Society of Automotive Engineers</td>
</tr>
<tr>
<td>NCMA</td>
<td>National Concrete Masonry Association</td>
</tr>
<tr>
<td>SAMA</td>
<td>Scientific Apparatus Makers Association</td>
</tr>
<tr>
<td>NEC</td>
<td>National Electrical Code</td>
</tr>
</tbody>
</table>
2.0 OWNERS RIGHTS AND RESPONSIBILITIES

2.1 CHANGES IN THE WORK: The Owner, without invalidating the Contract, may make changes in the Work and in the Drawings and Specifications therefore by making alterations therein, additions thereto, or omissions therefrom. All work resulting from such changes shall be
performed and furnished under and pursuant to the terms and conditions of the Contract. If such changes result in an increase or decrease in the work to be done hereunder, or increase or decrease the quantities thereof, adjustment in compensation shall be made therefore as provided in Subsection 7.12 PAYMENT FOR EXTRA WORK.

Except in an emergency endangering life or property, no change shall be made unless in pursuance of a written order from the Engineer authorizing the change, and no claim for additional compensation shall be valid unless the change is so ordered.

The Contractor agrees that he shall neither have nor assert any claim for, or be entitled to, any additional compensation for damages or for loss of anticipated profits on work that is eliminated.

2.2 PROJECT ENGINEER: Jennifer Oetgen, P.E. of Hussey Gay Bell

2.3 ENGINEER’S AUTHORITY: The Engineer will be the Owner’s representative during the construction period and he will observe the work in progress on behalf of the Owner. The Engineer will have the authority to act on behalf of the Owner in the following matters consistent with Owner’s right and obligations as set forth in these Contract Documents.
   1. Interpretation of Contract Documents.
   2. Approval of samples and shop drawings.
   3. Preparation of supplementary details and instructions.
   4. Inspection and approval of construction work.
   5. Preliminary approval of progress payment applications.

2.4 LIABILITY OF OWNER: No person, firm or corporation, other than the Contractor, who signed this Contract as such, shall have any interest herein or right hereunder. No claim shall be made or be valid either against the Owner or any agent of the Owner and neither the Owner nor any agent of the Owner shall be liable for or be held to pay any money, except as herein provided. The acceptance by the Contractor of the payment as fixed in the final estimate shall operate as and shall be a full and complete release of the Owner and of every agent of the Owner of and from any and all claims, demands, damages and liabilities of, by or to the Contractor for anything done or furnished for or arising out of or relating to or by reason of the work or for or on account of any act or neglect of the Owner or of any agent of the Owner or of any other person, arising out of, relating to or by reason of the work, except the claim against the Owner for the unpaid balance, if any there be, of the amounts retained as herein provided.

2.5 RIGHTS-OF-WAY AND SUSPENSION OF WORK: The Owner shall furnish all land and rights-of-way necessary for carrying out this Contract and the completion of the Work herein contemplated; and will use due diligence in acquiring said land and rights-of-way as speedily as possible. It is possible that all lands and rights-of-way may not be obtained as contemplated herein before construction begins. In this event the Contractor shall begin his work upon such land and rights-of-way as the Owner may have previously acquired. No claim for damages will be allowed whatsoever by reason of delay in obtaining the remaining lands and rights-of-way.

Should the Owner be prevented or enjoined from proceeding with the work, or from authorizing its prosecution, either before or after the commencement, by reason of any litigation, or by reason
of its inability to procure any lands or rights-of-way for the said work, the Contractor shall not be
titled to make or assert claim for damage by reason of said delay or to withdraw from the contract
except by consent of the Owner; but time for completion of the work will be extended to such time
as the Owner determines will compensate for the time lost by such delay, such determination to be
set forth in writing.

2.6 SURVEYS, PERMITS AND REGULATIONS: The Owner will furnish all boundary surveys
and establish all base lines for location the principal component parts of the Work together with a
suitable number of bench marks adjacent to the Work as shown in the Contact Documents.

Encroachment permits, easements for permanent structures and permits for permanent changes in
existing facilities shall be secured and paid for by the Owner, unless otherwise specified.

2.7 LINES, GRADES AND MEASUREMENTS: The Owner’s Engineer will set sufficient base
lines and elevations as shown on the Drawings for location of the Work. The Contractor shall
employ a registered civil engineer, or land surveyor and shall require said Engineer to establish all
lines, elevations, reference marks, batter boards, etc., needed by the Contractor during the progress
of the work, and from time to time to verify such marks by instrument or other appropriate means.

The datum adopted by the Engineer is NAVD 29. All elevations shown on the Drawings or
referred to in these specifications refer to this datum.

The Owner’s Engineer shall be permitted at all times to check the lines, elevations, reference
marks, batter boards, etc., set by the contractor, who shall correct any errors in lines, elevation,
reference marks, batter boards, etc., disclosed by such check. Such check shall not be construed
to be an approval of the Contractor’s work and shall not relieve or diminish in any way the
responsibility of the Contractor for the accurate and satisfactory construction and completion of
the entire work.

The Owner’s Engineer shall have access to all field notes. Field notes will be recorded in bound
field books, and carbon copies given the Owner’s Inspector at the close of each shift.

2.8 OWNER’S RIGHT OF AUDIT : The Owner is to have a full and complete right to audit and
make copies of Contractor’s or Subcontractor’s records with respect to any payment that the
Owner may be requested to make, or may make, for any work done on the project. Further, the
contractor will furnish all documents necessary for the Owner to obtain a Certified Audit of the
entire project.

2.9 OWNER’S RIGHT TO SEPARATE CONTRACTS: The Owner reserves the right to let other
contracts in connection with the Work under similar General Conditions. The Contractor shall
afford other contractors reasonable opportunity for introduction and storage of their materials and
the execution of their work, and shall properly connect and coordinate his work with theirs.

The Owner may perform additional Work related to the Project by himself, or he may let other
contracts containing provisions similar to these. The Contractor will afford the other contractors
who are parties to such contracts (or the Owner, if he is performing the additional Work himself),
reasonable opportunity for the introduction and storage of materials and equipment and the execution of Work and shall properly connect and coordinate his Work with theirs.

2.10 OWNER’S RIGHT TO DO WORK: If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this Contract, the Owner, after three (3) days’ written notice to the Contractor may, without prejudice to any other remedy he may have, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor. If such expense shall exceed the unpaid balance, the Contractor shall pay the difference to the Owner on demand.

The Engineer’s certificate setting forth the fair and reasonable cost of repairing, replacing, rebuilding or restoring any damaged or defective work or equipment when performed by one other than the Contractor shall be binding and conclusive as to the amount thereof upon the Contractor.

2.11 OWNER’S RIGHT TO TERMINATE CONTRACT: The Owner may, without prejudice to any other right or remedy, and after giving the Contractor and his surety, if any, seven days’ written notice, terminate the employment of the Contractor and take possession of the premises and of such materials as it may deem expedient if:

1. The Contractor should be adjudged a bankrupt,
2. The Contractor should make a general assignment for the benefit of his creditors,
3. A receiver or trustee should be appointed on account of the Contractor’s insolvency,
4. The Contractor should persistently or repeatedly refuse or should fail, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials,
5. The Contractor should fail to make prompt payment to Subcontractors or suppliers of material or labor,
6. The Contractor should persistently disregard laws, ordinances or the instructions of the Owner and his representatives, or otherwise be guilty of substantial violation of any provision of the Contract

In such case, the Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the contract price shall exceed the expense of finishing the work including compensation for additional engineering, managerial and administrative services, such excess shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the Contractor shall pay the difference to the Owner.

2.12 SUSPENSION OF WORK, TERMINATION AND DELAY: The Owner may suspend the Work or any portion thereof for a period of not more than ninety days or such further time as agreed upon by the Contractor, by written notice to the Contractor and the Engineer, which notice shall fix the date on which Work shall be resumed. The Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension.

2.13 INSPECTIONS AND TESTING: If the Contract Documents, Owner’s instructions, laws,
ordinances or any public authority having jurisdiction require any work to be specially tested or approved, the Contractor shall give the Owner timely notice of its readiness for observation by the Owner or inspection by another authority and, if the inspection is by another authority rather than the Owner, of the date fixed for such inspection.

The required certificates of such inspection shall be secured by the Contractor. Observations by the Owner shall be promptly made and, where practicable, at the source of supply. If any work should be covered up without approval or consent of the Owner, it must, if required by the Owner, be uncovered for examination at the Contractor’s expense.

2.14 INSPECTION OF WORK AWAY FROM THE SITE: If the work to be done away from the construction site is to be inspected on behalf of the Owner during its fabrication, manufacture, or testing or before shipment, the Contractor shall give notice to the Engineer of the place and time where such fabrication, manufacture, testing, or shipping is to be done. Such notice shall be in writing and delivered to the Engineer in ample time so that the necessary arrangements for the inspection can be made.

2.15 PIPE LOCATION: Exterior pipelines will be located as indicated on the Drawings, but the Owner reserves the right, acting through the Engineer, to make such modifications in location as may be found desirable to avoid interference with structures or for other reasons. Where fittings, etc., are noted on the Drawings such notation is for the Contractor’s convenience and does not relieve him from laying and jointing different or additional items where required.

2.16 PRIOR USE OR OCCUPANCY: The Owner reserves the right to use or occupy the Work or portion thereof, and to use equipment installed under the Contract, prior to final acceptance. Such use or occupancy will not constitute acceptance of the Work or any part thereof. Despite such use or occupancy, guarantee periods will not begin until the completion of all work under the Contract, unless agreement to the contrary is made in writing between the parties.

2.17 WEATHER CONDITIONS: In the event of temporary suspension of work, or during inclement weather, or whenever the Engineer shall direct, the Contractor will, and will cause his subcontractors to, protect carefully his and their work and materials against damage or injury from the weather. If, in the opinion of the Engineer, any work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or any of his subcontractors so to protect its work, such materials shall be removed and replaced at the expense of the Contractor.

2.18 OWNER’S RIGHT TO CLEAN UP: If a dispute arises between the separate contractors as to their responsibility for cleaning up, the Owner may clean up, the Owner may clean up and charge the cost thereof to the Contractor as the Engineer shall determine to be just.

3.0 CONTRACTOR’S RIGHTS AND RESPONSIBILITIES

3.1 ACCESS TO WORK: The Owner, the Engineer, and their officers, agents, servants, and employees plus representatives of the various participating Federal or State agencies may, at any and all times and for any and all purposes, enter upon the work and site thereof and the premises used by the Contractor, and the Contractor shall at all times provide safe and proper facilities
therefore.

3.2 ACCIDENT PREVENTION: In the performance of the Contract the Contractor shall comply with the applicable provisions of the regulations issued by the Secretary of Labor pursuant to section 107 of the Contract Work Hours and Safety Standards Act entitled “Safety and Health Regulations for Construction” (29 CFR 1518, renumbered as Part 1926). Occupational Safety and Health Standards (29 CFR Part 1910) issued by the Secretary of Labor pursuant to the Williams-Steiger Occupational Safety and Health Act of 1970 are applicable to work performed by the Contractor subject to the provisions of the Act.

3.3 STATED ALLOWANCES: The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. These allowances shall cover the net cost of the materials and equipment delivered and unloaded at the site and all applicable taxes. The Contractor’s handling costs on the site, labor, installation costs, overhead, profit and other expenses contemplated for the original allowance shall be included in the Contract Sum and not in the allowance. If the cost, when determined, is more than or less than the allowance, the Contract Sum shall be adjusted accordingly by Change Order which will include additional handling costs on the site, labor, installation costs, overhead, profit and other expenses resulting to the Contractor from any increase over the original allowance.

3.4 ARCHAEOLOGICAL RIGHTS: There is a possibility that items of archaeological significance may be found during the excavation of the site. In such event, the Contractor shall stop excavation in the vicinity of the find and notify the Engineer immediately; subsequent excavation work shall proceed as directed by the Engineer. All items found which are considered to have archaeological significance are the property of the Owner.

3.5 AS-BUILT DRAWINGS: The Contractor shall designate one set of Drawings for “As-Built Drawings”. The Contractor shall indicate on these drawings all field changes affecting various mechanical, electrical, piping and other items as well as locations as actually installed. The “As-Built Drawings” will be kept current by the Contractor. The “As-Built Drawings” shall be delivered to the Engineer upon completion and acceptance of the Work. Final payment for the Work will not be made until the “As-Built Drawings” have been completed and delivered as indicated above.

3.6 SURVEYS, PERMITS AND REGULATIONS: From the information provided by the Owner, unless otherwise specified in the Contract Documents, the Contractor shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stakes for pile locations and other working points, lines, elevations and cut sheets. The Contractor shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, he shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.

The Contractor shall obtain any required state and local permits, licenses, inspections, and certificates necessary for the prosecution of the work. The Contractor shall obtain these documents, and pay the fees assessed, for each division of work for which such permits, licenses, and inspections are required. The Contractor shall also obtain and pay the fees for general permits
such as Building Permits and Certificates of Occupancy.

The Contractor shall give all notices and comply with all applicable Federal, State and municipal
laws, codes, ordinances, rules and regulations bearing on the conduct of the Work as drawn and
specified. If the Contractor observes that the Contract Documents are at variance therewith, he
shall promptly notify the Engineer in writing, and any necessary changes shall be adjusted as
provided in Subsection 2.1 entitled CHANGES IN THE WORK.

3.7 LINES, GRADES AND MEASUREMENTS: The Contractor shall employ, at his own
expense, a competent civil engineer or land surveyor who shall be registered in South Carolina
and who shall be thoroughly experienced in field layout work. Said Engineer shall establish all
lines, elevations, reference marks, etc., needed by the Contractor during the progress of the Work,
and from time to time he shall verify such marks by instrument or by other appropriate means.

Alignment and grade of all pipe, tunnels, and borings shall be continuously controlled by use of
lasers established through the pipe or casing, not transferred from another medium. The Contractor
shall furnish lasers and accessories as required and approved by the Engineer. The Contractor’s
Engineer will set and check each laser each day that work is in progress or more often as required
to assure continuous accurate control.

The Contractor shall make all measurements and check all dimensions necessary for the proper
construction of the work called for by the Drawings and Specifications. During the prosecution
of the Work, he shall make all necessary measurements to prevent mis-fitting in said work, and he
shall be responsible therefore, and for the accurate construction of the entire work.

The Contractor’s Engineer responsible for lines and grades shall verify to the Owner in writing
that work has been constructed to lines and grades as shown on the Drawings. This certification
shall accompany each request for payment.

3.8 OBLIGATIONS OF CONTRACTOR: The Contractor shall and will, in good workmanlike
manner, do and perform all work and furnish all supplies and materials, tools, machinery,
equipment, transportation, supervision, temporary construction of any nature, and all other
services, means and facilities except as herein otherwise expressly specified, necessary or proper
to perform and complete all work required by this Contract, within the time herein specified, in
accordance with the provisions of this Contract and in accordance with the Drawings and
Specifications and in accordance with the direction of the Engineer as given from time to time
during the progress of the work. He shall furnish, erect, maintain and remove such construction
plant and such temporary works as may be required.

The Contractor shall observe, comply with, and be subject to all terms, conditions, requirements,
and limitations of the Contract and Specifications, and shall do, carry on, and complete the entire
work to the satisfaction of the Engineer and the Owner.

The Contractor shall check all dimensions, elevations, quantities and instructions shown on the
Drawings or given in the Specifications and shall notify the Engineer should any discrepancy of
any kind be found in the Drawings, Specifications or conditions at the site. He will not be allowed
to take advantage of any discrepancy, error or omission in the Contract Documents. If any
discrepancy is discovered, the Engineer will issue full instructions pertaining thereto and the
Contractor shall carry out these instructions as if originally specified.

3.9 CLAIMS FOR ADDITIONAL COST: If the Contractor wishes to make a claim for an increase
in the Contract Sum, he shall give written notice thereof within twenty days after the occurrence
of the event giving rise to such claim. This notice shall be given by the Contractor before
proceeding to execute the Work, except in an emergency endangering life or property, in which
case the Contractor shall proceed in accordance with Subsection 3.28 entitled PROTECTION OF
WORK, PROPERTY AND PERSONS IN AN EMERGENCY. No such claim shall be valid
unless so made. If the Owner and the Contractor cannot agree on the amount of the adjustment in
the contract Sum, it shall be determined by the Engineer. Any change in the Contract sum resulting
from such claim shall be authorized by Change Order.

3.10 CLAIMS FOR DAMAGE: If the Contractor makes claim for any damages alleged to have
been sustained by breach of contract or otherwise, he shall, within ten (10) days after occurrence
of the alleged breach or within ten (10) days after such damages are alleged to have been sustained,
whichever date is the earlier, file with the Engineer a written, itemized statement in triplicate of
the details of the alleged breach and the details and amount of the alleged damages. The Contractor
agrees that unless such statement is made and filed as so required, his claim for damages shall be
deemed waived, invalid and unenforceable, and that he shall not be entitled to any compensation
for any such alleged damages. Within ten (10) days after the timely filing of such statement, the
Engineer shall file with the Owner one copy of the statement together with his recommendations
for action by the Owner.

The Contractor shall not be entitled to claim any additional compensation for damages by reason
of any direction, instruction, determination or decision of the Engineer, nor shall any such claims
be considered, unless the Contractor shall have complied in all respects with the last paragraph of
Subsection 2.3 entitled ENGINEER’S AUTHORITY, including, but not limited to, the filing of
written protest in the manner and within the time therein provided.

3.11 CUTTING AND PATCHING: The Contractor shall leave all chases or openings for the
installation of his own or any other contractor’s subcontractor’s work, or shall cut the same in
existing work, and shall see that all sleeves or forms are at the work and properly set in ample time
to prevent delays. He shall see that all such chases, openings, and sleeves are located accurately
and are of proper size and shape and shall consult with the Engineer and the contractors and
subcontractors concerned in the reference to this work.
In case of his failure to leave or cut all such openings or have all such sleeves provided and set in
proper time, he shall cut them or set them afterwards at his own expense, but in so doing he shall
confine the cutting to the smallest extent possible consistent with the work to be done. In no case
shall piers or structural members be cut without the written consent and approval of the Engineer.

The Contractor shall carefully fit around, close-up, repair, patch, and point around the work
specified herein to the satisfaction of the Engineer.

All of his work shall be done by careful workmen competent to do such work and with the proper
small hand tools. Power tools shall not be used except where, in the opinion of the Engineer, the type of tool proposed can be used without damage to any work or structure and without inconvenience or interference with the operation of any facility. The Engineer’s approval of the type of tool shall not in any way relieve or diminish the responsibility of the Contractor for such damage, inconvenience or interference resulting from the use of such tools.

The Contractor shall not cut or alter the work of any subcontractor or any other contractor, nor permit any of his subcontractors to cut or alter the work of any other contractor or subcontractor except with the written consent of the contractor or subcontractor whose work is to be cut or altered or with the written consent of the Engineer. All cutting and patching or repairing made necessary by the negligence, carelessness, or incompetence of the Contractor or any of his subcontractors shall be done by or at the expense of the Contractor and shall be the responsibility of the Contractor.

3.12 CLEANING UP: The Contractor at all times shall keep the site of the work free from rubbish and debris caused by his operation under the Contract. When the work has been completed, the Contractor shall remove from the site of the work all of his plant, machinery, tools, construction equipment, temporary work and surplus materials so as to leave the work and the site clean and ready for use.

All public streets adjacent to the site and all private ways at the site shall be kept clean of debris, spilled materials, and wet and dry earth at all time and shall be cleaned at the end of each working day. When wet earth is encountered, it shall be cleaned from the vehicles before they leave the site and enter streets and private ways.

3.13 NON-COMPLIANCE WITH CONTRACT REQUIREMENTS: In the event the Contractor, after receiving written notice from the Owner of non-compliance with any requirement of this Contract, fails to initiate promptly such action as may be appropriate to comply with the specified requirement within a reasonable period of time, the Owner shall have right to order the Contractor to stop any or all work under the Contract until the Contractor has complied or has initiated such action as may be appropriate to comply within a reasonable period of time. The Contractor will not be entitled to any extension of contract time or payment for any costs incurred as a result of being ordered to stop work for such cause.

3.14 OVERALL PROJECT COORDINATION: The Contractor shall coordinate all Work of his Contract to produce the required finished Project in accordance with the Contract Documents. Special attention shall be given to the submission of shop drawings, samples, color charts, and requests for substitution within the specified time; furnishing the proper shop drawings to Subcontractors and material suppliers, whose work and equipment is affected by and related thereto; and the furnishing of all information concerning location, type, and size of built-in equipment and materials and equipment utilities. This coordination is in addition to all other coordination requirements called for in the technical sections of the Specifications.

3.15 COMMUNICATIONS: The Contractor shall forward all communications to the Owner through the Engineer.
3.16 NO DISCRIMINATION IN EMPLOYMENT: In connection with the performance of work under this Contract, the Contractor agrees not to discriminate against any employee or applicant for employment because of race, religion, color, or national origin. The aforesaid provision shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

3.17 DRAWINGS AND SPECIFICATIONS AT THE SITE: The Contractor shall maintain at the site one complete set of all Drawings, Specifications, Addenda, approved Shop Drawings, Change Orders and other Modifications, in good and readable condition and marked to record all changes made during construction. These shall be available to the Engineer. The Drawings, marked to record all changes made during construction, shall be delivered to the Engineer for the Owner upon completion of the work.

3.18 EMPLOY COMPETENT PERSONS: The Contractor shall endeavor to employ only competent persons on the Work. Whenever the Engineer notifies the Contractor in writing that in his opinion any person on the Work is incompetent, unfaithful, disorderly, or otherwise unsatisfactory, or not employed in accordance with the provisions of the Contract, such person shall be discharged from the Work and shall not again be employed on it, except with the written consent of the Engineer. Provided, however, that the failure of the Owner or Engineer to object to an employee is not to be considered acknowledgment or approval of the employee’s competence by the Engineer or Owner.

3.19 EMPLOY SUFFICIENT LABOR AND EQUIPMENT: If, in the judgment of the Engineer, the Contractor is not employing sufficient labor, plant, equipment or other means to complete the Work within the time specified, the Engineer may, after giving written notice, require the Contractor to employ such additional labor, plant, equipment and other means as the Engineer may deem necessary to enable the Work to progress properly.

3.20 EXISTING STRUCTURES: Where the dimensions and locations of existing structures are of importance in the installation or connection of any part of the Work, the Contractor shall verify such dimensions and locations in the field before the fabrication of any material or equipment which is dependent on the corrections of such information.

3.21 BENCH MARKS, PROPERTY CORNERS AND MONUMENTS: The Contractor shall maintain, carefully, all benchmarks, property corners, monuments and other reference points encountered. If disturbed or destroyed, the Contractor shall obtain the services of a Registered Land Surveyor to replace them, or pay for the replacement by appropriate authorities, at the Contractor’s own expense.

3.22 INDEMNIFICATION: The Contractor shall indemnify and hold harmless the Owner and the Engineer and their agents and employees from and against all claims, damages, losses and expenses, including attorneys’ fees, arising out of or resulting from the performance of the Work, provided that any such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting therefrom; and is caused in whole or in part by any negligent or willful act or omission
of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable.

In any and all claims against the Owner or the Engineer, or any of their agents or employees, by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under worker’s compensation acts, disability benefit acts or other employee benefits acts.

3.23 INTOXICATING LIQUORS: The Contractor shall not sell and shall neither permit nor suffer the introduction or use of intoxicating liquors upon or about the Work.

3.24 LEGAL ADDRESS OF CONTRACTOR: The Contractor’s business address and his office at or near the site of the Work are both hereby designated as places to which communications may be delivered. The depositing of any letter, notice, or other communication in a postpaid wrapper directed to the Contractor’s business address in a post office box regularly maintained by the U. S. Postal Service or the delivery at either designated address of any letter, notice, or other communication by mail or otherwise shall be deemed sufficient service thereof upon the Contractor, and the date of such service shall be the date of deposit. The first-named address may be changed at any time by an instrument in writing, executed and acknowledged by the Contractor and delivered to the Engineer. Service of any notice, letter or other communication upon the Contractor personally shall likewise be deemed sufficient service.

3.25 MUTUAL RESPONSIBILITY OF CONTRACTORS: The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials/equipment and the execution of their work, and shall properly connect and coordinate his Work with theirs.

If any part of the Contractor’s Work depends for proper execution or results upon the work of any other separate contractor, the Contractor shall inspect and promptly report to the Owner any apparent discrepancies or defects in such work that render it unsuitable for such proper execution and results. Failure of the Contractor so to inspect and report shall constitute an acceptance of the other contractor’s work as fit and proper to receive his Work, except as to defects which may develop in the other separate contractor’s work after the execution of the contractor’s Work. To ensure proper execution of the subsequent work, the Contractor shall measure work already in place and shall at once report to the owner any discrepancy between the executed work and the Contract Documents.

Should the Contractor cause damage to any separate contractor on the Work, the Contractor agrees, upon due notice, to settle with such contractor by agreement or arbitration, if he will so settle. If such separate contractor sues the Owner on account of any damage alleged to have been so sustained, the Owner shall notify the Contractor, who shall defend such proceedings at the Contractor’s expense, and if any judgment against the Owner arises therefrom, the Contractor shall pay or satisfy it and pay all costs incurred by the Owner.

3.26 WORK HOURS: The Contractor shall maintain a normal work schedule, consisting of five (5) days of eight (8) hours each or four (4) days of ten (10) working hours each per week. Night,
Weekend, and Holiday work will not be permitted unless it meets the requirements of the following section AND has written approval of the Owner.

Work performed by the Contractor at his own volition outside such customary working hours shall be at no additional expense to the Owner.

Any requests received by the Contractor from occupants of existing buildings to change the hours of work shall be referred to the Owner for determination.

3.27 NIGHT AND SUNDAY WORK: No work shall be done at night or on Sunday except:

1. Usual protective work, such as pumping and the tending of lights and fires;
2. Work done in case of emergency threatening injury to persons or property;
3. When provided for under Supplemental Conditions as herein specified;

If all of the conditions set forth in the next paragraph below are met no work other than that included in (1), (2), and (3) above, shall be done at night except when:

a. In the judgment of the Engineer, the work will be of advantage to the Owner and can be performed satisfactorily at night;
b. The work will be done by a crew organized for regular and continuous night work;
c. The Engineer has given written permission for such night work.

Any work necessary to be performed after regular hours, on Sundays, or on Legal Holidays shall be performed without additional expense to the Owner.

3.28 OCCUPYING PRIVATE LAND: The Contractor shall not (except after written consent from the proper parties) enter or occupy with men, tools, materials, or equipment, any land outside the rights-of-way or property of the Owner. A copy of the written consent shall be given to the Engineer prior to occupation of private land.

3.29 DEWATERING EXCAVATIONS: The Contractor shall remove and dispose of water in all excavations for pipelines, structures, and appurtenances so that construction can be carried out under relatively dry conditions. The dewatering shall be accomplished by the use of pumps, ditches, well points, or other approved methods, as required. Excavations shall be de-watered and brought to the specified grade prior to installation of any permanent structure, and shall be maintained in this relatively dry condition throughout project construction.

3.30 PRECAUTIONS DURING ADVERSE WEATHER: During adverse weather and against the possibility thereof, the Contractor shall take all necessary precautions so that the Work may be properly done and satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, wood and building-paper shelters, or other approved means.

During cold weather, materials shall be preheated, if required, and the materials and adjacent structure into which they are to be incorporated shall be made and kept sufficiently warm so that a proper bond will take place and a proper curing, aging, or drying will result. Protected spaces
shall be artificially heated by approved means which will result in a moist or a dry atmosphere according to the particular requirements of the work being protected. Ingredients for concrete and mortar shall be sufficiently heated so that the mixture will warm throughout when used.

The Engineer may suspend construction operations at any time when, in his judgment, the conditions are unsuitable or the proper precautions are not being taken, whatever the weather may be, in any season. The Contractor agrees that he shall not have or assert any claim for or be entitled to any additional compensation or damages on account of any such suspension.

3.31 PROTECTION OF WORK, PROPERTY AND PERSONS: The Contractor will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. He will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees on the Work and other persons who may be affected thereby, all the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

The Contractor will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. He will erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection. He will notify owners of adjacent utilities when prosecution of the Work may affect them. The Contractor will remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by the Contractor, any subcontractor, or anyone directly or indirectly employed by any of them or anyone for which acts any of them maybe liable, except damage or loss attributable to the acts or omissions of the Owner or the Engineer or anyone employed by either of them or anyone for whose acts either of them may be liable and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of the Contractor.

3.32 PROTECTION OF WORK, PROPERTY AND PERSONS IN AN EMERGENCY: In emergencies affecting the safety of persons or the Work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the Engineer or Owner, shall act to prevent threatened damage, injury or loss. He will give the Engineer prompt Written Notice of any significant changes in the Work or deviations from the Contract Documents caused thereby, and a Change Order shall thereupon be issued covering the changes and deviations involved.

3.33 PROTECTION AGAINST WATER AND STORM: The Contractor shall take all precautions necessary to prevent damage to the Work by storms or by water entering the site of the Work directly or through the ground. In case of damage by storm or water, the Contractor shall at his own cost and expense make such repairs or replacements or rebuild such parts of the Work as the Engineer may require in order that the finished work may be completed as required by the Contractor.

3.34 PROTECTION OF EXISTING VEGETATION, STRUCTURES, UTILITIES, AND IMPROVEMENTS: The Contractor will preserve and protect all existing vegetation such as trees,
shrubs, and grass on or adjacent to the site of the work which is not to be removed and which does
not unreasonably interfere with the construction work. Care shall be taken in removing trees
authorized for removal to avoid damage to vegetation to remain in place. Any limbs or branches
of trees broken during such operations or by the careless operation of equipment or by workmen
shall be trimmed with a clean cut and painted with a tree pruning compound as approved by the
Engineer.

The Contractor will protect from damage all existing improvements or utilities at or near the site
of the work, the location of which is made known to him, and will repair or restore any damage to
such facilities resulting from failure to comply with the requirements of this Contract or the failure
to exercise reasonable care in the performance of the Work. If the Contractor fails or refuses to
repair any such damage promptly, the Owner may have the necessary work performed and charge
the cost thereof to the Contractor.

The Contractor shall enclose the trunks of trees adjacent to his work and not to be cut with
substantial wooden boxes of such height as may be necessary to protect them from injury from
piled material, from equipment, from his operation, or otherwise due to his work. Excavating
machinery and cranes shall be of suitable type and shall be operated with care to prevent injury to
trees not to be cut and particularly to overhanging branches and limbs.

On paved surfaces, the Contractor shall not use or operate tractors, bulldozers or other power
operated equipment, the treads or wheels of which are so shaped as to cut or otherwise injure such
surfaces.

3.35 RESTORATION OF PROPERTY: All existing surfaces, including lawns, grassed and
planted areas which have been injured by the Contractor’s operations, shall be restored to a
condition at least equal to that in which they were found immediately before work was begun.
Suitable materials and methods shall be used for such restoration. All restored plantings shall be
maintained by cutting, trimming, fertilizing, etc., until acceptance. The restoration of existing
property or structures shall be done as promptly as practicable and shall not be left until the end of
the construction period.

3.36 INTERFERENCE WITH AND PROTECTION OF STREETS: The Contractor shall not
close or obstruct any portion of a street, road, or private way without obtaining permits therefore
from the proper authorities. If any street, road or private way shall be rendered unsafe by the
Contractor’s operations, he shall make such repairs or provide such temporary ways or guards as
shall be acceptable to the proper authorities.

Streets, roads, private ways, and walks not closed shall be maintained passable and safe by the
Contractor, who shall assume and have full responsibility for the adequacy and safety of provisions
made therefore.

The Contractor shall, at least 24 hours in advance, notify the highway, police and fire departments
in writing, with a copy to the engineer, if the closure of a street or road is necessary. He shall
cooperate with the police department in the establishment of alternate routes and shall provide
adequate detour signs, plainly marked and well lighted, in order to minimize confusion.
3.37 WORK IN STATE, CITY AND COUNTY RIGHTS-OF-WAY: Attention is directed to the fact that work will be going on in County, City and State rights-of-way. The Owner has obtained permission for the Contractor to encroach on these rights-of-way for work.

The Contractor will be required to conform to the requirements of the South Carolina Department of Highways and Public Transportation, the Charleston County Public Works Department, and the North Charleston Public Works while working within the rights-of-way.

Attention is directed to the fact that existing drainage pipes and ditches will be disturbed during the course of work. Any pipe which is damaged during construction shall be replaced with new pipe of the same size and material. Drainage ditches disturbed by the construction are to be graded to drain and grassed upon completion of the construction.

3.38 SCDHEC DISTRICT ENGINEER INSPECTION: All of the work constructed on this project, related to water and sewer lines and appurtenances, is subject to the inspection and approval by the South Carolina Department of Health and Environmental Control District Engineer. This inspection and acceptance is in addition to inspection and acceptance of the Engineer.

3.39 EASEMENTS: The Owner has obtained, or will obtain, permanent easements and temporary construction easements through private property. The temporary construction easements entitle the Contractor to the occupancy and use of the designated area near or adjacent to the work for purposes related to the work.

The Contractor will not encroach on any property unless easements have been obtained. On all land, the Contractor has no rights unless he obtains permission from the proper parties.

3.40 TRAFFIC CONTROL: The Contractor will comply with the South Carolina Department of Highways and Public Transportation manual entitled “Traffic Controls for Street and Highway Construction and Maintenance Operations, Part V, of the South Carolina Manual on Uniform Traffic Control Devices for Streets and Highways, 1982” and provide traffic control as required and approved by the South Carolina Department of Highways and Public Transportation.

Upon completion and acceptance of the work or as the need for temporary traffic control devices ceases, they shall be removed by the Contractor. Signs shall be used where warranted to maintain traffic or to call attention to conditions on, or adjacent to, the construction work. Such signs shall be removed when they are no longer required.

All traffic control and marking devices shall be in accordance with the provisions of the “State of South Carolina Uniform Manual on Traffic Control Devices”. Upon completion and acceptance of the work or as the need for temporary traffic control devices ceases, they shall be removed by the Contractor and shall remain the property of the Contractor.

3.41 DANGER SIGNALS AND SAFETY DEVICES: The Contractor shall make all necessary precautions to guard against damages to property and injury to persons. He shall put up and
maintain in good condition, sufficient red or warning lights at night, suitable barricades and other
devices necessary to protect the public.

In case the Contractor fails or neglects to take such precautions, the Owner may have such lights
and barricades installed and charge the cost of this work to the Contractor. Such action by the
Owner does not relieve the Contractor of any liability incurred under this Specification or contract.

3.42 CONSTRUCTION DRAINAGE: The Contractor shall furnish all labor, materials and
necessary equipment for the temporary control of surface water and seepage water during
construction and keep all excavations, pits and trenches free from water at all times.

The Contractor shall furnish and operate pumps and other equipment required. Dikes and ditches
shall be constructed around excavations and elsewhere as necessary to prevent surface water from
flooding the excavations or standing in areas adjacent to excavations, in work areas or in material
storage areas. The Contractor shall take all necessary precautions to protect adjacent areas and
properties at points other than that which would be considered the natural flow, prior to
construction, without the expressed consent of the Owner in writing with a copy to the Engineer.
He shall take steps to prevent the erosion of soil, earth and other material and the conduction of
the eroded materials onto adjacent properties and shall be responsible for the removal of such
materials and the restoration of adjacent areas to their original condition.

3.43 RETURNS OF DRAWINGS: All copies of Drawings, Specifications and other Documents
furnished by the Owner or the Engineer to the Contractor may be used only in connection with
prosecution of the Work and shall be returned by the Contractor upon completion of the Work.

3.44 SITE INVESTIGATION: The Contractor acknowledges that he has investigated and satisfied
himself as to the conditions affecting the Work, including but not restricted to those bearing upon
transportation, disposal, handling and storage of materials, availability of labor, water, electric
power, roads and uncertainties of weather, river stages, water table, tides or similar physical
conditions at the site, the conformation and conditions of the ground, the character of equipment
and facilities needed preliminary to and during prosecution of the Work.

The Contractor further acknowledges that he has satisfied himself as to character, quality and
quantity of surface and subsurface materials or obstacles to be encountered insofar as this
information is reasonable ascertainable from an inspection of the site, including all exploratory
work done by the Owner, as well as from information presented by the Drawings and
Specifications made a part of this Contract.

Any failure by the Contractor to acquaint himself with the available information will not relieve
him from responsibility for estimating properly the difficulty or cost of successfully performing
the work. The Owner assumes no responsibility for any conclusions or interpretations made by
the Contractor on the basis of the information made available by the Owner.

3.45 SOIL EROSION AND SEDIMENT CONTROL: The Contractors attention is directed to the
fact that unless exposed earth areas are properly cared for during construction, they may result in
substantial sedimentation damage downstream from the construction area.
The Contractor shall be responsible for conducting his site grading and drainage operations in such manner as to prevent soil erosion of the construction site work areas. He shall at all times provide satisfactory means to prevent the movement and washing of soil onto pavements or into adjacent ditches, swales, inlets, and drainage pipes, to avoid the possibility of these structures becoming clogged with soil. He shall promptly repair all areas which may become eroded and shall clear drainage ditches, swales, and structures of siltation.

The Contractor shall indemnify and save harmless the Owner and Engineer from and against any and all claims, demands, fines, or assessments, including attorneys’ fees and cost of defense arising out of or caused by the Contractor’s failure to provide soil erosion and sediment control.

3.46 SUBSURFACE CONDITIONS: The Contractor shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the Owner by Written Notice of:

1. Subsurface or latent physical conditions of the site differing materially from those indicated in the Contract Documents.

2. Unknown physical conditions at the site of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents.

The Owner shall promptly investigate the conditions, and if he finds that such conditions do so materially differ and cause and increase or decrease in the cost of, or in the time required for, performance of the Work, and equitable adjustment shall be made and the Contract Documents shall be modified by the Change Order. Any claim of the Contractor for adjustment hereunder shall not be allowed unless he has given the required Written Notice: provided that the Owner may, if he determines that the facts so justify, consider and adjust any such claims asserted before the date of final payment.

3.47 SUBCONTRACTING: The Contractor may utilize the services of specialty Subcontractors on those parts of the Work which, under normal contracting practices, are performed by specialty Subcontractors. The Contractor will, without additional expense to the Owner, utilize the services of specialty Subcontractors on those parts of the Work which are specified to be performed by specialty Subcontractors.

The Contractor shall not award any work to a subcontractor without prior written approval of the Owner, which approval will not be given until the Contractor submits to the Owner a written statement concerning the proposed award to the subcontractor, which statement shall contain such information as the Owner may require. No request for payment will be approved before this list has been received and reviewed by the Owner.

The Contractor shall not award Work to Subcontractor(s) in excess of fifty (50%) percent of the Contract Price without prior written approval of the Owner.

The Contractor will be fully responsible to the Owner for the acts and omissions of his
Subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts or omissions of persons directly employed by him.

The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the Work to bind Subcontractors to the Contractor by the terms of the Contract Documents insofar as applicable to the Work of Subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provisions of the Contract Documents.

If any other contractor or any subcontractor of such other contractor shall suffer or claim to have suffered loss, damage or delay by reason of the acts or omissions of the Contractor or of any of his subcontractors, the Contractor agrees to assume the defense against any such claim and to reimburse such other contractor or subcontractor for such loss, damage or delay and from and against any and all claims, demands, costs and expenses, including attorney’s fees, arising out of, relating to or resulting from such claims.

The Contractor shall be responsible for the coordination of the trades, subcontractors, and material men engaged upon his Work. The Owner or Engineer will not undertake to settle any differences between the Contractor and his subcontractors or between subcontractors. If any Subcontractor on the project, in the opinion of the Engineer, proves to be incompetent or otherwise unsatisfactory, he shall be replaced if and when directed in writing.

3.48 SUPERVISION: The Contractor shall keep on his Work, during its progress, a competent superintendent and any necessary assistants, all satisfactory to the Owner. The superintendent shall not be changed except with the consent of the Owner, unless the superintendent proves to be unsatisfactory to the Contractor and ceases to be in his employ. The superintendent shall represent the Contractor in his absence and all directions given to him shall be as binding as if given to the Contractor. Important directions shall be confirmed in writing to the Contractor. Other directions shall be so confirmed on written request in each case. The Owner shall not be responsible for the acts or omissions of the superintendent or his assistants.

The Contractor shall give efficient supervision to the Work, using his best skill and attention. He shall carefully study and compare all Drawings, Specifications and other instructions and shall at once report to the Owner any error, inconsistency or omission which he may discover.

3.49 TAXES: The Contractor shall promptly pay all federal, state and local taxes which may be assessed against him in connection with the Work or his operations under the agreement and/or the other Contract Documents, including, but not limited to, taxes attributable to the purchase of materials and equipment, to the performance of services, and the employment of persons in the prosecution of the Work.

3.50 TEMPORARY HEAT: The Contractor shall provide temporary heat whenever necessary to protect all Work and materials against injury from dampness and cold and to dry out moisture from the building. Fuel, equipment and method of heating shall be satisfactory to the Owner’s Insurer and the Engineer.
3.51 TEMPORARY UTILITIES: The Contractor shall make arrangements for and furnish as a part of the Contract, all electricity, water lighting and other utilities needed to do the Work called for by the Contract. Any separate contractors having a contract with the Owner shall make arrangements for and share the cost with the Contractor for the use of the required utilities on a pro-rated schedule based on an agreed basis. All Electrical Work shall comply with the National Electric Code.

The Contractor shall provide and pay for all temporary wiring, switches, connections and meters. The Contractor shall provide sufficient electric lighting so that all work may be done in a workmanlike manner when there is not sufficient daylight.

3.52 UNCOVERING AND CORRECTION OF WORK: The Engineer shall be furnished by the Contractor with every reasonable facility for examining and inspecting the Work and for ascertaining that the Work is being performed in accordance with the requirements and intent of the Contract, even to the extent of requiring the uncovering or taking down of portions of finished Work by the Contractor.

Should the Work thus uncovered or taken down prove satisfactory, the cost of uncovering or taking down and the replacement thereof shall be considered as extra Work unless the original Work was done in violation of the Contract in point of time or in the absence of the Engineer of his inspector and without his written authorization, in which case said cost shall be borne by the Contractor. Should the Work uncovered or taken down prove unsatisfactory, said cost shall likewise be borne by the Contractor.

The inspection of the Work shall not relieve the Contractor of any of his obligations to perform and complete the Work as required by the Contract. Defective Work shall be corrected and unsuitable materials, equipment, apparatus and other items shall be replaced by the Contractor, notwithstanding that such Work, materials, equipment, apparatus and other items may have been previously overlooked or accepted or estimated for payment.

If the Work or any part thereof shall be found defective at any time before the final acceptance of the Work, the Contractor shall forthwith make good such defect in any manner satisfactory to the Engineer. If any materials, equipment, apparatus or other items brought upon the site for use or incorporation in the Work, or selected from the same, are condemned by the Engineer as unsuitable or not in conformity with the Specifications or any of the other Contract Documents, the Contractor shall forthwith remove such materials, equipment, apparatus and other items from the site of the Work and shall at his own cost and expense make good an replace the same and any material furnished by the Owner which shall be damaged or rendered defective by the handling of improper installation by the Contractor, his agents, servants, employees or subcontractors.

If the Owner deems it inexpedient to correct Work injured or done not in accordance with the Contract, an equitable deduction from the Contract Price shall be made therefore.

3.53 COOPERATION WITH UTILITIES: The Owner will notify all utility companies, all pipeline owners, or other parties affected, and endeavor to have all necessary adjustments of the public or private utility fixtures, pipe lines, and other appurtenances within or adjacent to the limits of
construction, made as soon as practicable.

During the course of construction, the Contractor shall maintain in operating condition all active utilities such as gas, electric, telephone, water, sewer, gutters and other drains encountered in the new utility installation: and shall repair to the satisfaction of the Owner any surface, aerial or subsurface utility damage unless such utility is shown to be abandoned or removed.

Water lines, gas lines, wire line, sewer lines, water and gas meter boxes, water and gas valve boxes, manholes, light standards, cableways, signals, and all other utility appurtenances within the limits of the proposed construction which are to be relocated or adjusted are to be moved by the Owners under separate agreement, except as otherwise noted on the Drawings.

The Drawings will show all known utilities located within the limits of the contract according to information obtained. The accuracy of the Drawings in this respect is not guaranteed by the Owner. The Contractor shall have considered in his bid all of the permanent and temporary utility appurtenances in their present or relocated position. No additional compensation will be allowed for any delays, inconveniences, or damages sustained by him due to any interference from the said utility appurtenances or the operation of moving them.

Unless otherwise provided, the cost of temporary rearrangement of utilities made only in order to facilitate the construction of the Work will be borne by the Contractor.

3.54 WORK WITHIN DRAINAGE DITCH RIGHTS-OF-WAY: Where any portion of the project is to be constructed within the rights-of-way maintained by the County Public Works Department for drainage, the Owner will obtain permission from these agencies to construct within their rights-of-way. The Contractor will be required to conform to the requirements of the County Public Works Department while working within the drainage rights-of-way.

3.55 WORK ADJACENT TO TELEPHONE, POWER AND GAS COMPANY STRUCTURES: Where work is being performed within the telephone company or electric and gas company rights-of-way, the Owner has acquired, or will acquire, permission from these agencies to construct facilities within their rights-of-way or easements. In all cases where work is being performed near telephone company or electric or gas company facilities, the Contractor will notify the respective companies of areas in which work is being performed.

3.56 WORK BEING PERFORMED NEAR WATER LINES: The Contractor will inform the Town or City having jurisdiction as to the areas where work is being performed. It is required of a Contractor to obtain permission from the appropriate Water Authority where alterations to their system are required.

3.57 WORK IN RAILROAD RIGHTS-OF-WAY: Some work for this project may occur within railroad rights-of-way. The Contractor will be required to conform to the requirements of each railroad company while working within the rights-of-way. The Contractor must contact the Engineer and each railroad company prior to commencing any work within the rights-of-way.
3.58 UTILITY LOCATIONS: Prior to beginning any excavation, the Contractor shall notify all public utility companies and have their lines located and marked.

3.59 VERIFICATION OF DIMENSIONS AND ELEVATIONS: Dimensions and elevations indicated on the Drawings in reference to existing structures, location of utilities, sewer inverts, or other information on existing facilities, are the best available data obtainable but are not guaranteed by the Engineer. The Engineer will not be responsible for their accuracy. Before proceeding with any work dependent upon the data involved, the Contractor shall field check and verify all dimensions, grades, inverts, lines, elevations, or other conditions or limitations at the site of the work to avoid construction errors or damage to existing facilities. If any work is performed by the Contractor or a subcontractor prior to adequate verification of applicable data, any resultant extra cost for adjustment of work necessary to conform to existing facilities shall be assumed by the Contractor without reimbursement or compensation by the Owner.

If the Contractor, in the course of the work, finds any discrepancy between the Drawings and the physical conditions of the locality, or any errors or omissions in the Drawings or in the layout as given by survey points and instructions, he shall immediately inform the Engineer, in writing. The Engineer will promptly investigate the reported conditions and issue such instructions as may be necessary for the proper execution of the work. Any work done after such discrepancy and prior to receipt of such instructions shall be at the risk of the Contractor.

4. MATERIALS, EQUIPMENT AND WORKMANSHIP

4.1 CONTRACTOR’S TITLE TO MATERIALS: No materials or supplies for the Work shall be purchased by the Contractor or by any subcontractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. The Contractor warrants that he has good title to all materials and supplies used by him in the Work, free from all liens, claims or encumbrances.

4.2 CORRECTION OF WORK BEFORE COMPLETION: The Contractor shall promptly remove from the premises all work condemned by the Owner as failing to conform to the Contract Documents, whether incorporated or not and the Contractor shall promptly replace an re-execute his own work in accordance with the Contract and without expense to the Owner and shall bear the expense of making good all work of other contractors destroyed or damaged by such removal or replacement. The fact that the Engineer may have previously overlooked such defective work shall not constitute an acceptance of any part of it.

If the Contractor does not remove such condemned work within a reasonable time, fixed by written notice, the Owner may remove it, and after storing it at the job site for 30 days, due written notice thereof being given the Contractor, the Owner may offer the material for sale and removal from the premises. Net proceeds from such sale shall be for the Contractor’s credit against the “Owner’s Right To Do Work”. If the material has no sale value, the Owner may remove it from the premises and/or otherwise dispose of it. The cost of such disposition shall be deducted for payments to the Contractor as provided in Subsection 2.10 entitled OWNER’S RIGHT TO DO WORK.

4.3 CORRECTION OF WORK AFTER COMPLETION: The Contractor shall remedy any
defects due to faulty materials or workmanship and pay for any damage to other work resulting therefrom which shall appear within a period of two years from the date of final acceptance of the work except where longer periods are specified and in accordance with the terms of any special guarantees provided in the Contract.

4.4 CORRECTIONS OF WORK AFTER GUARANTEE PERIOD: It shall be the responsibility of the Contractor to permanently correct all defective items called to his attention within the guarantee period, whether such correction be made within the guarantee period or not. The Contract shall not be fully performed until such permanent corrections are made.

4.5 GENERAL GUARANTY: The Contractor warrants to the Owner that all materials and equipment furnished under this Contract will be new unless otherwise specified, and that all Work will be of good quality, free from faults and defects and in conformance with the Contract Documents. All Work not so conforming to these standards may be considered defective. If required by the Owner, the Contractor shall furnish all satisfactory evidence as to the kind and quality of materials and equipment.

Neither the final certificate of payment nor any provision in the Contract Documents nor partial or entire occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.

The Contractor shall further guarantee for a period of 24 months that any building or buildings, constructed under this Project, shall be watertight and leak proof at every point in every area, except where leaks can be attributed to damage to the building by external forces other than storm or foundation settlement. He shall, immediately upon notification by the Owner of water penetration, determine the source of water penetration and, at his own expense, repair or replace any other damaged material to return the building or buildings to the original accepted condition.

In addition to the foregoing stipulations, the Contractor shall comply with all other guarantees and warranties referred to in any portions of the Contract Documents, the more stringent requirement governing. Unless otherwise specifically stated elsewhere in the Specifications, the date of beginning of all guarantee or warranty periods shall be the date of acceptance of the project.

If for any reason, the Contractor cannot guarantee any part of his work using material or construction methods which have been specified, or shown, he shall notify the Engineer in writing before Contracts are signed, giving reasons together with the name of the product and data on substitutions he can guarantee. Should the Contractor fail to so notify the Engineer prior to the signing of the Contracts, he will be held to have agreed to guarantee all Work specified of shown.

4.6 WARRANTY REPAIR WORK: The Contractor shall fully and unconditionally warrant the materials and workmanship of the project for a period of two years, beginning on the date of project completion.

The Contractor shall maintain both the Performance Bond and the Payment Bond in force
throughout the two-year warranty period.

The Contractor warrants that he shall investigate, in a sincere, thorough and workmanlike manner, all claims for warranty work within 48 hours of receipt of notice from the Owner of the need for same of existence of deficient parts or portions of the Project. Workmen responding to such notices, shall be skilled craftsmen prepared to perform best quality work. Deficiencies shall be corrected immediately.

The Contractor or his representative shall immediately upon investigation of a notice of deficiency, deliver a report of his findings in writing with 72 hours of receipt of a warranty work at the Contractors expense therefore.

The Contractor warrants that he shall pay all invoices for warranty work performed by the Owner due to his default under this clause. Should the Contractor fail or refuse to pay such invoice rendered by the Owner within 15 days of receipt, the Owner may enter claim with any court of competent jurisdiction for collection of same with interest at the maximum legal rate, together with all associated legal costs and attorney’s fees, as a breach of this Contract.

4.7 HANDLING AND DISTRIBUTION: The Contractor shall handle, haul and distribute all materials and all surplus materials in the different portions of the work as necessary or required; shall provide suitable and adequate storage room for materials and equipment during the progress of the work; and shall be responsible for the protection, loss of, or damage to materials and equipment furnished by him, until the final completion and acceptance of the Work.

Storage and demurrage charges by transportation companies and vendors shall be borne by the Contractor.

4.8 RIGHT TO MATERIALS: Nothing in the Contract shall be construed as vesting in the Contractor any right of property in the materials, equipment, apparatus and other items furnished after they have been installed or incorporated in or attached or affixed to the work or the site, but incorporated, attached or affixed, become the property of the Owner.

4.9 STORAGE OF MATERIAAL AND EQUIPMENT: All excavated materials, construction equipment, and materials and equipment to incorporated in the Work shall be placed so as not to injure any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work and to all public utility installations in the vicinity of the Work. Materials and equipment shall be kept neatly piled and compactly stored in such locations as will cause a minimum of inconvenience to public travel and adjoining owners, tenants and occupants.

4.10 MANUFACTURER’S DIRECTIONS: All manufactured articles, material and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer, unless herein specified to the contrary.

If the specifications or plans are contrary to the manufacturer’s directions, the manufacturer shall be contacted by the Contractor before proceeding with the Work and the Engineer advised if the manufacturer has any objections to the specified application.
4.11 MATERIALS, SERVICES AND FACILITIES: It is understood that, except otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all labor, supplies and materials, tools, machinery, equipment, transportation, supervision, temporary construction of any nature, and all other services, means and facilities of any nature whatsoever necessary to execute, complete, and deliver the Work within the specified time.

Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the Work. Stored materials and equipment to be incorporated in the Work shall be located so as to facilitate prompt inspection.

Materials, supplied and equipment shall be in accordance with samples submitted by the Contractor and approved by the Engineer.

4.12 MISCELLANEOUS ITEMS: The work to be done by the Contractor, specified and enumerated under this Contract, shall include any minor details of the Work not specifically mentioned in the Specifications or shown on the Drawings, but obviously necessary for the proper completion of the Work, which shall be considered incidental and as being a part of and included with the Work for which prices are given in the Bid. The Contractor will not be entitled to any additional compensation therefore.

Miscellaneous items and accessories which are not specifically mentioned, but which are essential to produce a complete and properly operating installation or usable structure or plant, providing the indicated function, shall be furnished and installed without change in the contract price. Such miscellaneous items and accessories shall be of the same quality standards, including material, style, finish, strength, class, weight and other applicable characteristics as specified for the major component of which the miscellaneous item or accessory is an essential part, and shall be approved by the Engineer before installation. The above requirement is not intended to include major components not covered by of inferable from the Drawings and Specifications.

4.13 MISTAKES OF CONTRACTOR: The Contractor shall promptly correct and make good any and all defects, damages, omissions, or mistakes, for which he and/or his agents, servants, employees or subcontractors are responsible, and he shall pay the Owner all costs, expenses, losses, and damages resulting therefrom or by reason thereof as determined by the Engineer.

4.14 PROTECTION AGAINST ELECTROLYSIS: Where dissimilar metals are used in conjunction with each other, or against concrete surfaces, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other approved materials.

4.15 ROYALTIES AND PATENTS: The Contractor shall pay all applicable royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and shall save the Owner harmless from loss on account thereof, except that the Owner shall be responsible for all such loss when a particular process or the product of a particular manufacturer or manufacturers is specified, but if the Contractor has information that the process of article specified is an
infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the Owner in writing.

4.16 CONSTRUCTION SCHEDULE: A construction schedule shall be submitted by the Contractor at the PRE-CONSTRUCTION conference for approval by the Engineer.

The construction schedule shall consist of a bar chart incorporating the bid items. Further breakdown of each bid item may be required for clarity. A cost curve shall be plotted on the bar chart. An update of the schedule will be furnished at the Engineer’s request, normally with each monthly submittal of Partial Pay Estimate.

The schedule shall be supported by copies of the proposed equipment, quotations showing the item identification, stated delivery time, and the date of expiration of the quotation. Current and valid quotations are required. These quotations shall be presented to the Engineer with the construction schedule.

4.17 SUBMITTAL SCHEDULE: Within twenty (20) days after execution and delivery of the Contract, the Contractor shall prepare and deliver to the Engineer a Submittal Schedule. This includes a list of all submittals required under the Contract. This list shall identify each major group of shop drawings, coordination drawings and schedules and each sample and the planned submission date for each.

After the Engineer’s review of the list of submittals, the Engineer will meet with the Contractor for a joint review and correction and adjustment, as necessary, for agreement on the submittal. In addition, at the meeting the duration of the review period for each submittal will be established. The Contractor’s planned submission date for each submittal shall allow no less than fifteen (15) working days for review and appropriate action before approval of the submittal becomes critical to the progress of the Contractor’s work. Within five (5) calendar days after the joint review, the Contractor shall make any necessary revisions to the list of submittals, including duration’s of the review periods, in accordance with the agreements reached during the joint review and submit two (2) revised copies to the Engineer. No application for partial payment will be approved until the submittal schedule is approved. The Engineer shall not review more than two sets of submittal data (original submittal and one re-submittal) for each item or material without compensation by the Contractor. In the event that additional reviews are required, The Contractor shall compensate the Engineer at a rate of $100.00 per hour for such review.

4.18 SHOP DRAWINGS: Shop Drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared by the Contractor or any Subcontractor, manufacturer, supplier or distributor, and which will illustrate some portion of the Work. It shall be the Contractor’s responsibility to furnish Shop Drawings as required by the technical specifications or as requested by the Engineer. These submittals must be made no later than is required by the submittal schedule.

Shop Drawings shall show the principal dimensions, weight, structural and operating features, space required, clearance, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the drawing. When it is customary to do so, when the dimensions are of particular
importance, or when so specified, the drawings shall be certified by the manufacturer of fabricator as correct for the Contract.

When so specified or if considered by the Engineer to be acceptable, manufacturer’s specifications, catalog data, descriptive manner, illustrations, etc., may be submitted for approval in place of shop and working drawings. In such case, the requirements shall be as specified for shop and working drawings, insofar as applicable except that the submission shall be in quadruplicate.

The Contractor shall be responsible for the prompt and timely submittal for all shop and working drawings so that there shall be no delay to the work due to the absence of such drawings.

The Contractor shall check the Shop Drawings, shall coordinate them (by means of coordination drawings wherever required) with the work of all trades involved before submission and shall indicate thereon his approval. Drawings and schedules submitted without evidence of the Contractor’s approval may be returned for re-submission.

By approving and submitting Shop Drawings, the Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, catalog numbers and similar data, or will do so, and that he has checked and coordinated Shop Drawings with the requirements of the Work and of the Contract Documents.

If drawings or schedules show variations from the contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in his letter of transmittal. If acceptable, the Engineer may approve any or all such variations and issue an appropriate change order. If the Contractor fails to describe such variations he shall not be relieved of the responsibility for executing the work in accordance with the Contract, even though such drawings or schedules may have been approved.

Each Shop Drawing or Coordination Drawing shall have a blank area 5 by 5 inches located adjacent to the title block. The title block shall display the following:

- Number and Title of Drawing
- Date of Drawing
- Revision number and date (if applicable)
- Project Title
- Name of the project building or facility
- Name of Contractor
- Name of Subcontractor (if applicable)
- Clear identity of contents and location of work

Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter thereof conforms to the Drawings and Specifications in all respects. All drawings which are correct shall be marked with the date, checker’s name, and indication of the Contractor’s approval, and then shall be submitted to the Engineer; other drawings shall be returned for correction.
The Contractor shall stamp all drawings which are to be submitted to the Engineer for approval. The rubber stamp shall incorporate the following items:

<table>
<thead>
<tr>
<th>PROJECT TITLE</th>
<th>CONTRACTOR’S NAME</th>
<th>APPROVED BY</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIFICATION SECTION</td>
<td>TRANSMITTAL NO.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The review of the Shop Drawings will be general only and shall not relieve or in any respect diminish the responsibility of the Contractor for details of design, dimensions, etc., necessary for the proper fitting and construction of the work as required by the Contract and for achieving the result and performance specified thereunder.

Should the Contractor submit for approval equipment that required modifications to the structures, piping, layout, etc., detailed on the Drawings, he shall also submit for approval details of the proposed modifications. If such equipment and modifications are approved, the Contractor, at no additional cost to the Owner, shall do no work necessary to make such modifications. Required structural changes shall be designed and detailed by an Engineer registered in the state in which the project will be constructed. Drawings shall be signed and show registration number or may have seal affixed.

Submission of Shop Drawings shall be accompanied by a copy of a transmittal letter containing Project name, Contractor’s name, number of drawings, titles, specifications section, and other pertinent data. The submittal shall include the following:

Four (4) legible copies of Shop Drawings or printed matter

The review of Shop Drawings will be performed by the Engineer as follows:

When the submittal conforms fully with the Contract Drawings and Specifications, the Engineer will approve it. The reproducible of each drawing or page of approved submittals will be stamped approved, signed, dated and returned to the Contractor. No changes shall be made on approved drawings by the Contractor. If the Contractor desires to make any changes from approved drawings, or pages of approved submittals, he shall notify the Engineer in writing that the approved material has been withdrawn and shall submit the substitution set in accordance with the above procedure.

When the submittal clearly does not conform with the Contract Drawings and Specifications, the Engineer will disapprove it by stamping “Rejected”. Rejected submittals shall be corrected and resubmitted within fourteen (14) calendar days from the date of rejection. Submittals which are rejected shall not be released for any work.

When the submittal has only minor deviations from the Contract Drawings and Specifications, the Engineer will note the deviations and omissions as may be appropriate and approve the submittal subject to the notations by stamping it “Approved as Noted”. Approved as Noted submittals may be released for fabrication of work at the Contractor’s risk; in any event the submittal shall be
corrected and resubmitted for approval within fourteen (14) calendar days from the date of approval as noted.

The Contractor shall be responsible for delays resulting from the rejection or approval as noted of incomplete, inadequate, incorrect or otherwise unacceptable submittals.

The Contractor shall assure that only drawings and pages of printed materials bearing the Engineer’s “Approved” stamp are allowed on the job site.

The Contractor shall submit, at the completion of the Project, one set of all reviewed and correct shop drawings, catalog cuts, and descriptive literature for all Work previously submitted. These sets shall be sent to the Engineer for the Owner before the final Certificate of Payment is issued.

4.19 OPERATING AND MAINTENANCE MANUALS: One copy of each is required Operating and Maintenance Manual must be submitted to the Engineer with the first submittal of shop drawings. Five additional copies of each required Operating and Maintenance Manual must be submitted to the Engineer within fourteen (14) calendar days of the return of the approved shop drawings to the Contractor. No payment will be approved on any equipment for which Operating and Maintenance Manuals are required until the Operating and Maintenance Manuals are received by the Engineer. These O&M manuals must be addressed specifically to the piece of equipment supplied and shall not be general in nature; each item must be clearly identified and located. Each page must be printed on 8 ½” x 11” paper or folded to that size in a manner which will be suitable for insertion in a 3-ring binder.

4.20 SAMPLES: Samples are physical examples furnished by the Contractor to illustrate materials, equipment or workmanship, and to establish standards by which the Work will be judged. It shall be the Contractor’s responsibility to furnish samples as required by the technical specifications or as required by the Engineer. These samples must be submitted no later than is required by the Submittal Schedule.

Each sample shall have a label indication:

- Project Title
- Name of the project building or facility
- Name of Contractor
- Name of Subcontractor (if applicable)
- Identification of material with specification section
- Name of producer and brand (if any)

Samples shall be submitted in duplicate unless otherwise noted in the technical specifications and shall be accompanied by a copy of a transmittal letter containing Project Name, Contractor’s Name, number of samples, specification section and other pertinent data.

If the Engineer so requires, either prior to or after commencement of the work, the Contractor shall submit samples of materials for such special tests as the Engineer deems necessary to demonstrate that they conform to the Specifications. Such samples shall be furnished, taken, stored, packed
and shipped by the Contractor as directed. Except as otherwise expressly specified, the Contractor shall make arrangements for, and pay for, the tests.

All samples shall be packed so as to reach their destination in good condition. To insure consideration of samples, the Contractor shall notify the Engineer by letter that the samples have been shipped and shall properly describe the samples in the letter. The letter of notification shall be sent separate from and should not be enclosed with the samples.

The Contractor shall submit data samples, or place his orders, sufficiently early to provide ample time for consideration, inspection, testing, and approval before the materials and equipment are needed for incorporation in the work. The consequences of his failure to do so shall be the Contractor’s sole responsibility.

In order to demonstrate the proficiency of workmen, or to facilitate the choice among several textures, types, finishes, surfaces, etc., the Contractor shall provide such samples of workmanship of wall, floor finish, etc., as may be required.

When required, the Contractor shall furnish to the Engineer triplicate sworn copies of manufacturer’s shop or mill tests (or reports from independent testing laboratories) relative to materials, equipment performance ratings, and concrete data.

4.21 INSPECTION AND TESTING: All materials and equipment used in the construction of the Project shall be subject to adequate inspection and testing in accordance with generally accepted standards, as required and defined in the Contract Documents.

The Owner shall provide all inspection and testing services not required by the Contract Documents.

The Contractor shall provide at his expense the testing and inspection services required by the Contract Documents.

If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority have jurisdiction require any Work to specifically be inspected, tested, or approved by someone other than the Contractor, the Contractor will give the Engineer timely notice of readiness. The Contractor will then furnish the Engineer the required certificates of inspection, testing or approval.

Inspections, tests, or approvals by the Engineer or others shall not relieve the Contractor from his obligations to perform the Work in accordance with the requirements of the Contract Documents.

The Engineer and his representatives will at all times have access to the Work. In addition, authorized representatives and agents of any participating Federal or State agency shall be permitted to inspect all work, materials, payrolls, records, records of personnel, invoices of materials, and other relevant data and records. The Contractor will provide proper facilities for such access and observation of the Work and also for any inspection or testing thereof.
If any Work is covered contrary to the written instructions of the Engineer, it must, if requested by the Engineer, be uncovered for his observation and replaced at the Contractor’s expense.

If the Engineer considers it necessary or advisable that covered Work be inspected or tested by others, the Contractor, at the Engineer’s request, will uncover, expose or otherwise make available for observation, inspection or testing as the Engineer may require, that portion of the Work in question, furnishing all necessary labor, materials, tools and equipment. If it is found that such Work is defective, the Contractor will bear all the expenses of such uncovering, exposure, observation, inspection and testing and if satisfactory reconstruction. If, however, such Work is not found to be defective, the Contractor will be allowed to increase in the Contract Price or and extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate Change Order shall be issued.

4.22 SUBSTITUTIONS: The Contractor may recommend the substitution of a material, article, or piece of equipment of equal function for those referred to in the Contract Documents by reference to brand name or catalogue number, and if, in the opinion of the Engineer, such material, article, or piece of equipment is of equal function to that specified, the Engineer may approve its substitution and use by the Contractor. Any cost differential shall be deductible from the Contract Price and the Contract Documents shall be appropriately modified by Change Order.

The Contractor warrants that if substitutes are approved, no major changes in the function or general design of the Project will result. Incidental changes or extra component parts required to accommodate the substitute will be made by the Contractor without a change in the Contract Price or Contract Time.

4.23 “OR EQUAL” CLAUSE: The phrase “or equal” shall be construed to mean that material or equipment will be acceptable only when in the judgment of the Engineer they are composed of parts of equal quality or equal workmanship and finish and are designed and constructed to perform or accomplish the desired result as efficiently as the indicated brand, pattern, grade, class, make or model.

When a material, article or piece of equipment is identified on the Drawings or in the Specifications by the reference to manufacturers’ or vendors’ names, trade names, catalogue numbers, etc., it is intended merely to establish a standard of quality and function; and any materials, article, or equipment of other manufactures and vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided the material, article, or equipment so proposed, is, in the opinion of the Engineer, of equal substance and function. It shall not be purchased or installed by the Contractor without the Engineer’s written approval.

4.24 WAGES AND OVERTIME COMPENSATION: The Contractor and each of his subcontractors shall comply with all applicable State and local laws or ordinances with respect to the hours worked by laborers and mechanics engaged in work on the project and with respect to compensation for overtime.

4.25 NO WAIVER: Neither the inspection by the Owner or the Engineer, nor any order,
measurement, approval, determination, decision or certificate by the Engineer, nor any order by
the Owner for the payment of money, nor any payment for or use, occupancy, possession or
acceptance of the whole or any part of the work by the Owner, nor the extension of time, nor any
other act or omission of the Owner or the Engineer shall constitute or be deemed to be an
acceptance of any defective or improper work, materials, or equipment nor operate as a waiver of
any requirement or provision of the Contract, or of any remedy, power or right of or herein reserved
to the Owner, nor of any right and remedy provided for herein or by law, the Owner shall be
entitled as of right to a writ of injunction against any breach or threatened breach of the Contract
by the Contractor, by his Subcontractors or by any other person or persons.

4.26 WORK TO CONFORM: During its progress and on its completion, the work shall conform
truely to the lines, levels, and grades indicated on the Drawings or given by the Engineer and shall
be built in a thoroughly substantial and workmanlike manner, in strict accordance with the
Drawings, Specifications, and other Contract Documents and the directions given from time to
time by the Engineer.

All work done without instruction having been given therefore by the Engineer, without prior lines
or levels, or performed during the absence of the Engineer, will not be estimate of paid for except
when such work is authorized by the Engineer in writing. Work so done may be ordered uncovered
or taken down, removed, and replaced at the Contractor’s expense.

5. INSURANCE, LEGAL RESPONSIBILITY AND SAFETY

5.1 COMPLIANCE WITH LAWS: The Contract shall be governed by the law of the State of
South Carolina. The Contractor shall abide by all local and State Laws or ordinances to the extent
that such requirements do not conflict with more stringent Federal laws or regulations. The
Contractor shall keep himself fully informed of all existing and future Federal, State and local
laws, ordinances, rules and regulations affecting those engaged or employed on the work, the
materials and equipment used in the work of the conduct of the work, and of all orders, decrees
and other requirements of bodies or tribunals having any jurisdiction or authority over the same,
including, but not limited to the US Department of Labor and Bureau of Standards Safety and
Health Regulations for Construction and its amendments as set up under the Williams-Steiger
Occupational Safety and Health Act of 1970. If any discrepancy or inconsistency is discovered in
the Drawings, Specifications or other Contract Documents in relation to any such law, ordinance,
rule, regulation, order, decree or other requirement, the Contractor shall forthwith report the same
to the Engineer in writing.

The Contractor shall at all times observe and comply with, and cause all his agents, servants,
employees, and subcontractors to observe and comply with, all such existing requirements, and he
shall protect, indemnify and save harmless the Owner, its officers, agents, servants, and employees
from and against any and all claims, demands, suits, proceedings, liabilities, judgments, penalties,
losses, losses, damages, costs and expenses, including attorney’s fees, arising from or based upon
any violation or claimed violation of any such law, ordinance, rule, regulation, order, decree, or
other requirement, whether committed by the Contractor or any of his agents, servant employees,
or subcontractors.
5.2 REQUIRED PROVISIONS DEEMED INSERTED: Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein, and the Contract shall be read and enforced as though it were included herein. If through mistake or otherwise any such provision is not inserted or is not correctly inserted, then upon the application of either party the Contract shall forthwith be physically amended to make such insertion or correction.

5.3 LIENS: If at any time any notice of lien is filed for labor performed or materials or equipment manufacturers, furnished, or delivered to or for the Work, the Contractor shall, at its own cost and expense, promptly discharge, remove or otherwise dispose of the same and until such discharge, removal or disposition, the Owner shall have the right to retain from any moneys payable hereunder and amount which, in its sole judgment, it deems necessary to satisfy such liens and pay the costs and expenses, including attorney’s fees, of defending any actions brought to enforce the same or incurred in connection therewith or by reason thereof.

5.4 CLAIMS: If at any time there is any evidence of any claims for which the Contractor is or may be liable or responsible hereunder, the Contractor shall promptly settle or otherwise dispose of the same, and until such claims are settled or disposed of, the Owner may retain from any moneys which would otherwise be payable hereunder so much thereof as, in its judgment, it may deem necessary to settle or otherwise dispose if such claims and to pay the costs and expenses, including attorney’s fees of defending any actions brought to enforce such claims or incurred in connection therewith or by reason thereof.

5.5 PERFORMANCE BOND AND PAYMENT BOND: Unless otherwise noted in the Supplemental Conditions, a Performance Bond and a Payment Bond are required. The Contractor shall obtain a Performance Bond and Payment Bond, (acceptable to the Owner in a surety company authorized to do business in the same state in which the Project is constructed), each for the full amount of the Contract Sum, The bonds shall guarantee the Contractor’s faithful performance of the Contract and the payment of all obligations arising thereunder. The bonds shall remain in force until:

The Project has been completed and accepted by the Owner;

The provisions of all guaranteed required by these Contract Documents have been fulfilled or the time limitation for all guarantees has expired; and

The time for the filing of all mechanics’ liens has expired after which it shall become void.

The Contractor shall pay all charges in connection with the bonds as a part of the Contract. One executed copy of the bonds shall be attached to each copy of the Contract before they are returned to the Engineer for the Owner’s signature.

If the Contractor defaults, the Contractor or his Surety shall reimburse the Owner for any additional Engineering fees for additional services made necessary because of the Contractor’s default.

5.6 ADDITIONAL OR SUBSTITUTE BOND: If at time the Owner for justifiable cause, shall be
or become dissatisfied with the surety or sureties for the Performance and/or Payment Bonds, the Contractor shall, within 5 days after notice from the Owner to do so, substitute an acceptable bond (or bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner. The premiums on such bond shall be paid by the Contractor. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished such an acceptable bond to the Owner.

5.7 CHANGES NOT TO AFFECT BONDS: It is distinctly agreed and understood that any changes made in the Work or the Drawings or Specifications therefore (whether such changes increase or decrease the amount thereof of the time required for its performance) or any changes in the manner or time of payments made by the Owner to the Contractor, or any other modifications of the Contract, shall in no way annul, release, diminish or affect the liability of the Surety on the Contract Bonds given by the Contractor, it being the intent hereof that notwithstanding such changes the liability of the Surety on said bonds continue and remain in full force and effect.

5.8 OWNER’S INSURANCE AUTHORITY: During all phases of construction, the Contractor will be required to perform his operations so as to comply expeditiously with the recommendations of the Owner’s Insurance Authority.

5.9 ASSIGNMENTS: The Contractor shall not assign the whole or any part of this Contractor any moneys due or to become due hereunder without written consent of the Owner. If the Contractors assigns all or any part of the moneys due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that is agreed that the right of the assignee in and to any moneys due or to become due to the Contractor shall be subject to prior claims of all persons, firms, and corporations for services rendered or materials supplied for the performance of the work called for in this Contract.

5.10 INSURANCE: The Contractor shall not commence any work until he obtains, at his own expense, all required insurance (such as Workers Compensation, Commercial General Liability (CGL) and Comprehensive Automobile Liability etc. as required). Such insurance must have the approval of the Owners as to limit, form, and amount. The contractor will not permit any Subcontractor to commence work on this project until the same insurance requirements have been complied with by the Subcontractor.

The Contractor shall furnish the Owner with the certificates showing the type, amount, class of operations covered, effective dates and dates of expiration of policies. Such certificates shall also contain substantially the following statement: “The insurance covered by this certificate will not be canceled or materially altered, except after ten (10) days notice in writing and delivered by registered mail to the Owner.” Should any policy be canceled before final payment by the Owner to the Contractor and the Contractor fail immediately to procure other insurance as specified, the Owner reserved the right to procure such insurance and to deduct the cost thereof from any sum due the Contractor under this Contract.

Any insurance bearing on adequacy of performance shall be maintained after completion of the project for the full guaranty period. Should such insurance be canceled before the end of the guaranty period and the Contractor fails immediately to procure other insurance as specified, the
Owner reserves the right to procure such insurance and to charge the cost thereof to the Contractor.

Nothing contained in these insurance requirements is to be construed as limiting the extent of the Contractor’s responsibility for payment for damages resulting from his operations under this Contract.

The Contractor is required to obtain and maintain for the full period of the Contract the following types of insurance coverage with limits not less than stated below:

WORKER’S COMPENSATION INSURANCE: As required by the State of South Carolina, with Statutory Limits, and Employer’s Liability Insurance with limit of no less than $1,000,000 per accident for bodily injury or disease.

COMMERCIAL GENERAL LIABILITY (CGL): Insurance Services Office (ISO) Form CG 00 01 12 07 covering CGL on an “occurrence” basis, including products-completed operations, personal and advertising injury, with limits no less than $1,000,000 per occurrence. If a general aggregate limit applies, the general aggregate limit shall be twice the required occurrence limit. This contract shall be considered to be an “insured contract” as defined in the policy.

COMPREHENSIVE AUTOMOBILE LIABILITY: ISO Form Number CA 00 01 covering any auto (Code 1), or if Contractor has no owned autos, hired, (Code 8) and non-owned autos (Code 9), with limits no less than $1,000,000 per accident for bodily injury and property damage.

SUBCONTRACTOR’S LIABILITY INSURANCE:

Same limits as required by the General Contractor.

5.11 ORAL AGREEMENTS: No oral order, objection, claim of notice by any party to the others shall affect or modify any of the terms or obligations contained in any of the Contract Documents, and none of the provisions of the Contract Documents shall be held to be waived or modified by reason of any act whatsoever, other than by a definitely agreed waiver or modification thereof in writing, and no evidence shall be introduced in any proceeding of any other waiver or modification.

5.12 SAFETY: In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property affected directly by his operations during the performance of the work. This requirement will apply continuously 24 hours per day until acceptance of the Work by the Owner and shall not be limited to normal working hours.

The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

All employees on the Work and all other persons who may be affected thereby;

All the Work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of the Subcontractors of
Sub-subcontractors; and

Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

The Contractor shall comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He shall erect and maintain, as required by existing conditions and progress of the Work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

When the use or storage of explosives or other hazardous materials or equipment is necessary for the execution of the Work, the Contractor shall exercise the utmost care and shall carry on such activities under the supervision of properly qualified personnel.

The Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor’s superintendent unless otherwise designated in writing by the Contractor to the Owner and the Engineer.

The Contractor shall not load or permit any part of the Work to be loaded so as to endanger its safety.

THE CONTRACTOR SHALL NOTIFY THE OWNER IMMEDIATELY OF ANY INJURIES OR PROPERTY DAMAGE DURING PROGRESS OF THE WORK.

6. PROGRESS AND COMPLETION OF WORK

6.1 NOTICE TO PROCEED: Following the execution of the Agreement by the Owner and the Contractor, written Notice to Proceed with the work shall be given by the Owner to the Contractor. The Contractor shall begin and shall prosecute the work regularly and uninterruptedly thereafter (except as provided for herein) with such force as to secure the completion of the work within the Contract Time.

6.2 CONTRACT TIME: The Contractor shall complete, in as acceptable manner, all of the work contracted for in the time stated in the Agreement. Computation of Contract Time shall commence the day to be specified in the Notice to Proceed and every calendar day following, except as herein provided, shall be counted as Contract Time.

6.3 SCHEDULE OF COMPLETION: The Contractor shall submit, at such times as may reasonably be requested by the Engineer, schedules showing the order in which the Contractor proposes to carry on the Work, with dates at which the Contractor will start the various parts of the Work, and estimated date of completion of each part.
6.4 WORK CHANGES: The Owner may, as the need arises, order changes in the work through additions, deletions, or modification to the extent of 25% of the Contract Amount, without invalidating the Contract. Compensation and time of completion affected by the change shall be adjusted at the time of ordering such change.

6.5 EXTRA WORK: New and unforeseen items of work found to be necessary, and which cannot be covered by an item or combination of items for which there is a Contract Price, shall be classed as Extra Work. The Contractor shall do such Extra Work and furnish such materials as may be required for the proper completion or construction of the whole work contemplated, upon written order from the Owner as approved by the Engineer. In the absence of such written order, no claim for Extra Work shall be considered. Extra Work shall be performed in accordance with these Contract Documents where applicable and work not covered by such shall be done in accordance with the best construction practice and in a workmanlike manner. Extra Work required in an emergency to protect life and property shall be performed by the contractor as required.

6.6 EXTENSION OF CONTRACT TIME: A delay beyond the Contractor’s control occasioned by an Act of God, by act or omission on the part of the Owner or by strikes, lockouts, fire, etc., may entitle the Contractor to an extension of time in which to complete the work as agreed by the Owner, provided, however, that the Contractor shall immediately give written notice to the Owner of the cause of such delay.

Act of God shall mean an earthquake, flood, cyclone or other cataclysmic phenomenon of nature. Rain, wind, flood, or other natural phenomenon of normal intensity for the locality shall not be construed as an Act of God and no reparation shall be made to the Contractor for damage to the Work resulting therefrom.

All claims for extension of time shall be made in writing to the engineer no more than twenty days after the occurrence of the delay; otherwise they shall be waived. In the case of continuing cause of delay only one claim is necessary. Any claim should include complete justification for the extent of the delay claimed.

The Subsection does not exclude the recovery of damages for delay for either party under other provisions of the Contract Documents.

6.7 ENGINEER’S CERTIFICATE OF SUBSTANTIAL COMPLETION: When the work to be performed under this Contract is substantially completed in accordance with the Contract Documents, the Engineer shall prepare an Engineer’s Certificate of Substantial Completion to be acknowledged and accepted by the Owner and the Contractor. The Certificate may list items to be completed or corrected but such Certificate shall not relieve the Contractor of his obligation to complete all work, whether listed or not, in accordance with the Contract Documents nor will it preclude any right the Owner may have for recourse in accordance with the Contract Documents.

6.8 TERMINATION OF CONTRACTOR’S RESPONSIBILITY: The Contract will be considered complete when all work has been finished, the final review made up by the Engineer, and the project accepted in writing by the Owner. The Contractor’s responsibility shall then cease, except as set forth in his Performance Bond, as provided in Subsection 4.6 entitled GENERAL
GUARANTY, and as provided in Subsection 6.9 entitled CORRECTION OF FAULTY WORK AFTER FINAL PAYMENT.

6.9 CORRECTION OF FAULTY WORK AFTER FINAL PAYMENT: The making of the final payment by the Owner to the Contractor shall not relieve the Contractor of responsibility for faulty materials or workmanship. The Contractor shall promptly replace any such defects discovered within two years, except where longer periods are specified, from the date of written acceptance of the work.

6.10 PROGRESS SCHEDULE: Within twenty (20) days after execution and delivery of the Agreement and not less than ten (10) days prior to making an application for partial payment, the Contractor shall prepare and deliver to the Engineer a Progress Schedule on forms approved by the Engineer.

The schedule shall be set up in a Critical Path format and shall show the proposed dates of commencement and completion of the various subdivisions of work required under the Contract Documents.

The schedule shall show the dates of commencement and completion of the various subdivisions of work required by the Contract Documents and all activities required to accomplish the Work. No activity included in the schedule shall have a duration greater than fifteen (15) days. After approval of the Submit Schedule, the Contractor shall incorporate this schedule into the CPM schedule.

The schedule shall be updated monthly. No progress payments will be made unless application is accompanied by the updated schedule.

6.11 SCHEDULES, REPORTS AND RECORDS: The Contractor shall submit to the Owner such schedules of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data where applicable as are required by the Contract Documents for the Work to be performed.

The Contractor shall also submit, in a format as approved by the Engineer, a schedule of payments that he anticipates he will earn during the course of the Work.

6.12 ABANDONMENT OF WORK OR OTHER DEFAULT: The Contractor may be declared in DEFAULT of the contract for the following reasons:

If the CONTRACTOR:
  1. abandons the work.
  2. sublets any part of the work without previous written permission of the OWNER.
  3. assigns the contract of any moneys payable hereunder in any manner other than as specified herein or, if at any time the Engineer shall be of the opinion, and shall so certify in writing, that:

    1. The conditions herein specified as to rate of progress are not being complied with.
2. The work or any part thereof is being unnecessarily or unreasonably delayed.
3. The Contractor has violated or is in default under any of the provisions of the Contract.
4. The Contractor becomes bankrupt or insolvent.
5. The Contractor goes or is put into liquidation or dissolution, either voluntarily or involuntarily.
6. The Contractor petitions for an arrangement or reorganization under the Bankruptcy Act.
7. The Contractor makes a general assignment for the benefit of creditors or otherwise acknowledges insolvency.

Upon a finding of DEFAULT by the Contractor, the Owner may notify the Contractor in writing with a copy of such notice mailed to the Surety, to discontinue such work or any part thereof.

The Contractor shall discontinue such work or such part thereof as the Owner may designate; and the Owner may, upon giving notice, by contract or otherwise as it may determine, complete the work or such part thereof and charge the entire cost and expense of so completing the work or such part thereof to the Contractor as specified under 2.10: OWNERS RIGHT TO DO WORK.

In addition to the said entire cost and expense of completing the work, the Owner shall be entitled to reimbursement from the Contractor and the Contractor agrees to pay the Owner any losses, damages, costs and expenses, including attorneys’ fees, sustained or incurred by the Owner by reasons of any of the foregoing causes.

For purposes of such completion the Owner may for itself or for any contractors employed by the Owner take possession of any and use or cause to be used any and all materials, equipment, plant machinery, appliances, tools, supplies and such other items of every description that may be found or located at the site of the Work. No equipment or materials may be removed from the Work without the written consent of the Owner.

All costs, expenses, losses, damages, attorneys’ fees and any and all other charges incurred by the Owner under this Subsection shall be charged against the Contractor and deducted and/or paid by the Owner out of any moneys due or payable or to become due or payable to the Contractor under the Contract.

In computing the amounts chargeable to the Contractor, the Owner shall not be held to a basis of the lowest prices for which the completion of the work or any part thereof might have been accomplished; but all sums actually paid or obligated therefore to effect its prompt completion shall be charged to and against the account of the Contractor.

In case the costs, expenses, losses, damages, attorneys’ fees and other charges together with all payment there-to-fore made to or for the account of the Contractor are less than the sum which would have been payable under the Contract if the work had been properly performed and completed by the Contractor, the Contractor shall be entitled to receive the difference.
In case such costs, expenses, losses, damages, attorneys’ fees and other charges, together with all payments there-to-fore made to or for the account of the Contractor, shall exceed the said sum, the Contractor shall pay the amount of the excess to the Owner.

6.13 FINAL INSPECTION: When the work has been completed and finished in accordance with the Contract, the Contractor shall notify the OWNER in writing, and request a final inspection.

The Owner and Engineer shall jointly review the work, after the Engineer is otherwise satisfied that all work on the project has been substantially completed in accordance with the contract documents and change orders.

A list shall be made of all deviations from the Contract requirements (commonly termed “punch list”) and a copy of such list furnished to the Contractor. The Contractor shall with reasonable haste remedy all defects so noted and shall notify the Owner upon the completion of such work.

When inspection by the Owner’s authorized representatives shows the work to be complete in accordance with the Contract, application for final payment may be made.

After project completion, funds may be withheld from the Contractor only if they are required to insure specific performance of deficient portions of the contract. The contractor shall be required to provide a representative for all work reviews and regulatory agency inspections. Work noted as requiring the attention of the Contractor, after satisfaction of the “Final Punch List” shall be considered as warranty work.

7. PAYMENTS TO THE CONTRACTOR

7.1 PRICES FOR WORK: The Owner shall pay and the Contractor shall receive the prices stipulated in the Bid made a part hereof as full compensation for everything performed and furnished and for all risks and obligations undertaken by the Contractor under and as required by the Contract.

7.2 SCHEDULE OF VALUES: Except in cases where unit prices form the basis for payment under the Contract, the Contractor shall, within twenty (20) days of the execution of the Contract and not less than ten (10) days prior to making an application for partial payment, submit to the Owner in a form approved by the Owner a schedule of values showing a breakdown of the Contract Sum itemized by trade and/or specification sections or as otherwise directed by the Owner and for each item shall show the total value including the Contractor’s overhead and profit. Upon approval by the Owner, this schedule will be used in determining the value of the work done for the purpose of partial payments.

The costs employed in making up any of these schedules will be sued only for determining the basis of partial payments and will not be considered as fixing a basis for additions to or deductions from the Contract Price.

7.3 APPLICATIONS FOR PARTIAL PAYMENT: Before the first day of each month, or as otherwise directed by the Owner, the Contractor shall make applications for the value of the work
done and the materials installed and/or delivered to the site for installation in the project during the previous month.

Such applications shall show the breakdown of the project into the same items as the schedule of values specified in Subsection 7.2 entitled SCHEDULE OF VALUES, and showing for each item the total value, the value previously reported as complete, the value completed during the month, the cumulative value completed and the value remaining to be done.

The application shall also show the value of materials delivered to the site which have not been incorporated into the work and whose value is not included in the amount shown for the work of which they are a part. The value of such materials shall be established by attaching copies of invoices covering the materials to the application.

The application shall include a summary of value of the work performed during the previous month, plus the value of the material delivered to the job site but not incorporated in the work, and minus the amount of the retainage indicated in Subsection 7.4 entitled RETAINAGE.

The Engineer will, within ten (10) days after receipt of each partial payment estimate, either indicate in writing his approval of payment and present the partial payment estimate to the Owner, or return the partial payment estimate to the Contractor indicating in writing his reasons for refusing to approve payment. In the latter case, the Contractor may make the necessary corrections and resubmit the partial payment estimate.

7.4 RETAINAGE: The Owner shall retain ten (10) percent of the amount of each payment until final completion and acceptance of all work covered by the Contract Documents. The Owner at any time, however, after fifty (50) percent of the work has been completed, if he finds that satisfactory progress is being made, may make further partial payments in full on the current and remaining estimates, but amounts previously retained shall not be paid to the Contractor at fifty (50) percent completion.

Any time thereafter, when, in the opinion of the engineer, the progress of the Work is not satisfactory, additional amounts may be retained but in no event shall the total retainage be more than ten (10) percent of the value of the work completed. Upon substantial completion of the work, any amount retained may be paid to the Contractor.

When the Work has been substantially completed except for Work which cannot be completed because of weather conditions, lack of materials or other reasons which in the judgment of the Owner are valid reasons for non-completion, the Owner may make additional payments, retaining at all times an amount sufficient to cover the estimated cost of the Work still to be completed.

7.5 PAYMENTS WITHHELD: The Owner may withhold payment or, on account of subsequently discovered evidence, nullify the whole or part of any application to the extent necessary to protect himself from loss on account of:

1. Defective work not remedied;
2. Claims filed or reasonable evidence indicating the probable filing of claims;

3. Failure of the Contractor to make payments to Subcontractors, material suppliers, or employees;

4. A reasonable doubt that the Contract work can be completed for the balance unpaid; or

5. Damage to another Contractor.

When the above grounds are removed, payment will be made for the amounts withheld because of them.

7.6 PAYMENT OF APPLICATIONS FOR PARTIAL PAYMENT: Upon verification and approval of the application for partial payment made as specified, the Owner will make payment of the amount found properly due. No payment made to the Contractor nor partial or entire use or occupancy of the Work by the Owner shall be an acceptance of any work or materials not in accordance with this Contract.

7.7 RELEASE OF LIENS: Neither the final payment nor any part of the retained percentage shall become due until the Contractor shall deliver to the Owner a complete and notarized release of all liens arising out of this Contract, or receipts in full in lieu thereof, and if required in either case, an affidavit that so far as he had knowledge or information the releases and receipts include all the labor and material for which a lien could be filed; but the Contractor may, if any Subcontractor refuses to furnish a release or receipt in full, furnish a bond satisfactory to the Owner, to indemnify him against any lien. If any lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all moneys that the latter may be compelled to pay in discharging such a lien, including all costs and reasonable attorneys’ fees.

7.8 USE OR PARTIAL PAYMENT NOT ACCEPTANCE: It is agreed that this is an entire contract for one whole and complete work or result and that neither the Owner’s entrance upon nor use of the Work or any part thereof nor any partial payments by the Owner shall constitute an acceptance of the Work or any part thereof before its entire completion and final acceptance.

7.9 PAYMENT FOR UNCORRECTED WORK: Should the Owner direct the Contractor not to correct work that has been damaged or that was not performed in accordance with the Contract Documents, an equitable deduction from the Contract Amount shall be made to compensate the Owner for the Uncorrected Work.

7.10 PAYMENT FOR REMOVAL OF REJECTED WORK AND MATERIALS: The removal of work and materials rejected in accordance with Subsection 4.3 entitled CORRECTION OF WORK BEFORE COMPLETION and the re-execution of acceptable work by the Contractor shall be at the expense of the Contractor, and he shall pay the cost of replacing the work of other contractors destroyed or damaged by the removal of the rejected work or materials and the subsequent replacement of acceptable work.
Removal of rejected work or materials and storage of materials by the Owner, in accordance with Subsection 4.3 entitled CORRECTION OF WORK BEFORE COMPLETION, shall be paid by the Contractor within thirty (30) days after written notice to pay is given by the Owner. If the Contractor does not pay the expenses of such removal and after ten (10) days’ written notice being given by the Owner of his intent to sell the materials, the Owner may sell the materials at auction or at private sale and will pay the Contractor the net proceeds therefrom after deducting all the costs and expenses that should have been borne by the Contractor.

7.11 PAYMENT FOR EXTRA WORK: Written notice of claims for payment for Extra Work shall be given by the Contractor within ten days after receipt of instructions from the Owner to proceed with the Extra Work and also before any work is commenced, except in emergency endangered life or property. No claim shall be valid unless so made. In all cases, the Contractor’s itemized estimate sheets showing all labor and material shall be submitted to the Owner.

Owner’s order for Extra Work shall specify any extension of the Contract Time and one of the following methods of payment:

1. Unit price or combinations or unit prices which form the basis of the original Contract.

2. A lump sum based on the Contractor’s estimate and accepted by the Owner.

3. Net cost plus a fixed fee. Net costs are defined as follows:

3.1 Labor costs, including time of foreman while engaged directly upon extra work at rates not greater than the scale of rated for each respective classification of labor customary in the area where the work is performed for each respective job classification.

3.2 Labor, insurance, and taxes, including amounts paid on a percent of such labor rates or on a cents per hour basis for Worker’s Compensation, Public Liability, Contractor’s Contingent Liability and Contractual Liability Insurance and all Federal Old Age and Unemployment Taxes and any other taxes applicable as well as fringe benefits as may be approved by the Engineer.

3.3 Materials and supplies actually used on the work.

3.4 Rental charges are necessary equipment, as agreed upon by the Owner and Contractor. Rental charges shall not exceed those published in Rental Rates for Construction Equipment issued by the American Equipment Distributor. Equipment and tools having a value of $100.00 or less are considered to be “small tools” and as such, are considered to be part of overhead.

To the cost under (3) there shall be added a fixed fee to be agreed upon but not to exceed fifteen (15) percent of the estimated cost of the work. The fee shall be compensation to cover the cost of supervision, overhead, bond, profit and
any other general expenses. On work performed by subcontractors, the fixed fee shall not exceed five (5) percent of the cost of work.

7.12 PAYMENT FOR WORK SUSPENDED BY THE OWNER: If the work or any part thereof shall be suspended by the Owner and abandoned by the Contractor as provided in Subsection 2.12 entitled SUSPENSION OF WORK, TERMINATION AND DELAY, the Contractor will then be entitled to payment for all work done on the portions so abandoned.

7.13 PAYMENT FOR WORK BY THE OWNER: The cost of the work performed by the Owner, in accordance with Subsection 2.10 entitled OWNER’S RIGHT TO DO WORK, shall be paid to the Contractor.

7.14 PAYMENT FOR WORK FOLLOWING TERMINATION OF CONTRACT BY OWNER: Upon termination of the Contract by the Owner in accordance with Subsection 2.11 entitled OWNER’S RIGHT TO TERMINATE CONTRACT, no further payment shall be due the Contractor until the work is completed. If the unpaid balance of the Contract Amount Shall Exceed the cost of completing the work shall exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The cost incurred by the Owner, as herein provided, and the damage incurred through the Contractor’s default shall be certified by the Owner.

7.15 PAYMENT FOR SAMPLES AND TESTING OF MATERIALS: Samples furnished in accordance with Subsection 4.18 entitled SAMPLES shall be furnished by the Contractor at his expense.

Testing of samples and materials furnished in accordance with Subsection 4.18 entitled SAMPLES shall be arranged and paid for by the Owner.

7.16 ACCEPTANCE AND FINAL PAYMENT: When the Contractor shall have completed the work in accordance with the terms of the Contract Documents, he shall certify completion of the work to the Owner and submit a final Request for Payment. This request shall be the Contract Amount plus all approved additions, less all approved deductions, less previous payments made.

The Contractor shall furnish evidence that he has fully paid all debts for labor, materials, and equipment incurred in connection with the work. Upon acceptance, the Owner will release the Contractor (except as to the conditions of the Performance Bond and the Payment Bond, and any legal rights of the Owner, required guaranties, and Correction of Faulty Work after Final Payment), and will pay the Contractor’s final Request for Payment.

The Contractor will allow enough time for the Engineer to assemble and check all necessary data. The Contractor shall deliver to the Owner a complete release of all liens arising out of this Contractor before the retained percentage of before the final Request for Payment is paid.

7.17 ACCEPTANCE OF FINAL PAYMENT AS RELEASE: The acceptance by the Contractor of final payment shall be and shall operate as a release to the Owner of all claims and all liability to the Contractor other than claims in stated amounts as may be specifically excepted by the Contractor for all things done or furnished in connection with this Work and for every act and
neglect of the Owner and other relating to or arising out of this Work. Any payment, however, final or otherwise, shall not release the Contractor or his sureties from any obligations under the Contract Documents or the Performance Bond and Payment Bond.

7.18 DELAYS AND DAMAGES: The date of beginning and the time of completion of the Work are essential conditions of the Contract Documents and the Work embraced shall be commenced on a date specified in the Notice to Proceed.

The Contractor will proceed with the Work at such a rate of progress to insure full completion within the Contract Time. It is expressly understood and agreed by and between the Contractor and the Owner that the Contract Time for the completion of the Work described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the Work.

If the Contractor refuses or fails to prosecute the Work, or any separable part thereof, with such diligence as will insure its completion within the time specified in the Contract, or any extension thereof, or fails to complete said Work within such time, the Owner may, by written notice to the Contractor and his Surety, terminate his right to proceed with the Work or such part of the work as to which there has been delay.

In such event the Owner may take over the Work and prosecute the same to completion, by contract and otherwise, and may take possession of and utilize in completing the work such materials, appliances, and plant as may be on the site of the work and necessary therefore.

Whether or not the Contractor’s right to proceed with the Work is terminated, he and his sureties shall be liable for any damage to the Owner resulting from his refusal or failure to complete the Work within the specified time.

If fixed and agreed liquidated damages are provided in the Contract and if the Owner so terminated the Contractor’s right to proceed, the resulting damage will consist of such liquidated damages until such reasonable time as may be required for final completion of the Work together with any increased costs occasioned by the Owner in completing the Work.

If fixed and agreed liquidated damages are provided in the Contract, and if the Owner does not so terminate the Contractor’s right to proceed, the resulting damage will consist of such liquidated damages until the Work is completed or accepted.

The Contractor’s right to proceed shall not be so terminated nor the Contractor charged with resulting damage if:

1. The delay in the completion of the Work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, Acts of God, acts of the public enemy, acts of the Government in either its sovereign or contractual capacity, acts of another contractor in the performance of a contract with the Owner, fires, flood, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, or delays or subcontractors or supplied arising
from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and such subcontractors or suppliers: and

2. The Contractor, within ten (10) days from the beginning of any such delay (unless the Owner grants a further period of time before the date of final payment under the Contract), notifies the Owner in writing of these causes of delay.

As used in subparagraph 1, above, the term “subcontractors or suppliers” means subcontractors or suppliers at any time.

The Engineer shall ascertain the facts and the extent of the delay and extend the time for completing the Work when, in his judgment, the findings of fact justify such an extension, and his findings of fact shall be final and conclusive on the parties, subject only to appeal as provided in these General Conditions.

The rights and remedies of the Owner provided in this clause are in addition to any other rights and remedies provided by law or under this Contract.

(End of Conditions)
1. **COMMENCEMENT AND COMPLETION OF WORK:**
The Contractor shall commence work under this contract within 10 calendar days after notice to proceed and shall diligently prosecute said work so as to complete the entire project and place it in use within 180 calendar days after notice to proceed.

2. **SCOPE OF THE WORK:**
The work to be done hereunder includes the furnishing of all necessary machinery, equipment, tools, labor and other construction means, and all materials and equipment required to perform all work as set forth and called for by the Plans and Specifications and including the placing of the entire project into satisfactory operation.

3. **LOCATION:**
The work under this Contract will be located in North Charleston, South Carolina as shown on the Drawings.

4. **EXTENSION OF TIME AND FAILURE TO COMPLETE ON TIME:**
Any and all extensions of time shall be in accordance with the General Conditions, except as otherwise hereinafter provided.

Failure to complete the Project on or before the stipulated completion date will result in the assessment of liquidated damages; such damages shall include the cost of engineering, inspection and testing, together with any fines or penalties incurred by the Owner for non-compliance with water quality requirements or effluent limitations in the amount stated in the Proposal.

5. **SANITARY REGULATIONS:**
The Contractor shall provide adequate sanitary conveniences for use of those employed on the work and their use shall be strictly enforced. Such conveniences shall be made available when the first employees arrive on the site and shall be removed after the departure of the last employees from the job. The facilities shall be maintained at such points and in such manner as approved, and the Engineer shall have the right to inspect such facilities to determine whether or not sanitary requirements have been complied with.

6. **ENVIRONMENTAL IMPACT:**
The Contractor shall conduct all his operations so as to minimize, to the greatest extent possible, adverse environmental impact.

   a) **Noise.**
   All equipment and machinery shall be provided with exhaust mufflers maintained in...
good working order so as to reduce operating noise to minimum levels. In addition, operation of equipment and machinery shall be limited to daylight hours, except with the permission of the Engineer, based on critical need for the operation.

b) Dust/Smoke.
All equipment movements shall be accompanied by a minimum of dust. Traveled surfaces and earthwork shall be maintained in a moist condition to avoid the generation of dust or the airborne movement of particulate matter under all prevailing atmospheric conditions.

Burning operations will be conducted only with written permission of the Owner and/or appropriate regulatory agency. The Contractor shall be responsible for obtaining all permits and complying with all codes, ordinances and regulations pertaining to the burning.

c) Traffic.
Trucks carrying spoil, fill, concrete or other material shall be routed over roads which will result in the least effect on traffic and nuisance to the public. All material shall be loaded in a manner which will preclude the loss of any portion of the load in transit, including covering, if necessary.

d) Siltation.
All points of concentrated runoff from rainfall shall be visually monitored to determine that no eroded material from the construction site is leaving the Owner’s property. Measures shall be taken to promptly eliminate such a deposition if occurring, including the installation of detention basins.

7. STORAGE OF MATERIALS:
The Contractor shall arrange his plant and store his materials as compactly as practicable at points convenient for the Contractor and which do not damage the work or interfere with the operation of the existing plant or with work of other contractors or with free access to all parts of the site and to utility installations. Materials shall be so stored as to facilitate inspection and to insure preservation of their quality and fitness for use. They shall be placed on wooden platforms or other clean surfaces and not on the ground and shall be placed under cover.

8. CONSTRUCTION STAKING:
The Engineer will provide benchmarks and baselines for horizontal and vertical control at the site of the work.

From the baselines and benchmarks established by the Engineer, the Contractor shall complete the layout of the work and shall be responsible for all measurements that may be required for the execution of the work prescribed in the specifications or on the Contract Plans, subject to such modifications as maybe required to meet changed conditions or as a result of necessary modifications to the contract work. The Contractor shall exercise proper and reasonable care in verifying figures shown on the Drawings before laying out the Work and will be responsible for any error resulting from his failure to exercise such care.
The Contractor shall furnish, at his own expense, all such stakes, spikes, steel pins, templates, platforms, equipment, instruments, tools and material and all labor including instrumentmen, rodmen, chainmen, etc., as may be required in laying out any part of the work from the baselines and benchmarks established by the Engineer.

It shall be the responsibility of the Contractor to maintain and preserve all stakes and other marks established by the Engineer until authorized to remove them, and if such marks are destroyed by the Contractor or through his negligence prior to their authorized removal, they may be replaced by the Engineer at his discretion, and the expense of replacement will be deducted from any amounts due or to become due the Contractor.

All survey data shall be recorded in accordance with standard and approved methods. All field notes, sketches, records and computations made by the Contractor in laying out the work shall be available at all times during the progress of the work for the ready examination by the Engineer or his duly authorized representative.

The Engineer may make original and final surveys and make computations to determine the quantities of work performed or finally in place, if required.

The Contractor shall make such surveys and computations as are necessary to determine the quantities of work performed or placed during each period for which a progress payment is to be made. All original field notes, computations and other records, or facsimile copies thereof, taken by the Contractor for the purpose of construction and for progress surveys, shall be furnished promptly to the representative of the Engineer for permanent records and for determining the proper amount of progress payments due to the Contractor. Unless waived in each specific case, quantity surveys made by the Contractor shall be made during the presence of a representative of the Engineer.

The Engineer may make checks as the work progresses to verify lines and grades established by the Contractor and to determine the conformance of the completed work as it progresses with the requirements of Contract Specifications and Plans. Such checking by the Engineer or his representative shall not relieve the Contractor of his responsibility to perform all work in accordance with the Contract Plans and Specifications and the lines and grades given therein. In the event that location marks as established by the Contractor are found to be inaccurate or inadequate, work shall be suspended until corrections have been made.

No separate payment will be made for the costs involved in the survey work, layout work or staking performed by the Contractor. All such costs will be considered as incidental to the Contract.

9. UTILITIES:
Utilities such as sewer, water and electric lines encountered in the work shall be protected from injury and maintained in service until moved or replaced as required under this Contract or by
others as the case may be, or abandoned lines as may be necessary for the proper construction and use of the new work.

10. **ADJUSTMENT OF DISCREPANCIES:**
In all cases of discrepancies between the various dimensions and details shown on drawings, or between the drawings and these specifications, the more expensive construction shall be estimated before construction is started, the matter shall be submitted to the Engineer for clarification. Without such a decision, discrepancies shall be adjusted by the Contractor at his own risk and in settlement of any complications arising from such adjustment, the Contractor shall bear all of the extra expense involved.

11. **TESTING:**
Testing shall be conducted as required in the various sections of these specifications, in accordance with the following:

   a) **Mill Tests.**
   Mill tests, if any, shall be conducted and reports submitted as specified for such material. Mill or shop tests shall be accomplished by the manufacturer or supplier of the materials, and may be conducted by an independent testing laboratory. These tests shall be performed in accordance with the ASTM Standard, if specified, or with other applicable standards.

   The cost of mill tests shall be included in the lump sum price bid, and no additional payment will be made.

   b) **Laboratory Tests.**
   Laboratory tests shall be conducted and test reports submitted where this type of test is specified. All laboratory tests shall be made by a reputable independent laboratory. These tests shall be performed in accordance with ASTM Standards, if specified, or other applicable standards if no reference is included.

   The Contractor shall arrange for all tests of preliminary samples of materials and mixtures, in order to determine suitability of source and for initial design mixes of concrete. The cost of these preliminary tests shall be included in the lump sum price of the contract and no additional payment will be made.

   Routine tests of materials incorporated into the project will be performed by an independent testing laboratory. Samples shall be provided by the Contractor. The Contractor will pay for all concrete cylinder tests and preliminary tests to determine initial design mixes.

   Soils tests for gradation, moisture content and density will be paid for by the Contractor and will be included in the price for the appropriate item in the Bid Proposal for the number of tests specified in the technical sections of this Specification.

   c) **Field Tests.**
Field tests of mechanical and electrical equipment, piping systems, electrical systems, control systems, ventilation systems, heating systems, water mains, pressure mains, sewers, drains, and similar facilities shall be conducted where this type of test is specified.

Field tests include determination of performance, capacity, efficiency, function, tightness, leakage or other special requirements. These tests shall be performed in accordance with applicable standards and test codes.

Field tests shall be set up and accomplished by the Contractor who shall provide all tools, equipment, instruments, personnel and other facilities required for the satisfactory completion of each test.

The cost of field tests shall be included in the unit price for the appropriate item in the Bid Schedule and no additional payment will be made for field testing.

d) Factory Tests.

Factory tests of mechanical and electrical equipment relative to performance, capacity, rating, efficiency, function or special requirements shall be conducted in the factory or shop for each item when this type of test is specified. These tests shall be performed in accordance with applicable standards and test codes.

Factory tests shall be set up and accomplished by the equipment manufacturer who shall provide all shop space, tools, equipment, instruments, personnel and other facilities required for the satisfactory completion of each test.

The cost of factory tests shall be included in the lump sum price of the Contract and no additional payment will be made for factory testing.

12. **REFERENCE STANDARDS:**

Reference to the standards of any technical society, organization, or association, or to codes of local or state authorities, shall mean the latest standard, code, specification, or tentative standard adopted and published at the date of taking bids, unless specifically stated otherwise.

13. **PROJECT MANAGEMENT:**

The Contractor shall schedule and coordinate the work of the Contractor and all subcontractors and others involved to maintain the accepted progress schedule. His duties shall also include the planning of the work, the scheduling of ordering and delivery of materials, and checking and control of all work under this Contract. Construction schedules shall be submitted to the Engineer for review prior to the start of any work. Schedules shall be verified or updated as necessary on a monthly basis.

The Contractor shall be responsible for complete supervision and control of his subcontractors as though they were his own forces. Notice to the Contractor shall be considered notice to all affected subcontractors.
The Contractor shall appoint a qualified representative to act as the Project Coordinator, or Superintendent, who shall be responsible for coordinating all work and providing liaison with the Engineer and the Owner. The Project Coordinator or Superintendent shall, in addition, plan the work, schedule the ordering and delivery of materials, and check and control the various phases of the construction of all work under this Contract. The Project Coordinator or Superintendent shall, in all matters, represent the Contractor at the sites of the work in the absence of a Corporate Officer or Principal of the firm.

The Project Coordinator or Superintendent shall not be changed unless the project Coordinator or Superintendent proves to be unsatisfactory to the Contractor and ceases to be in his employ.

14. EQUIPMENT ADJUSTMENT AND CALIBRATION:
All mechanical and electrical equipment, including related control systems, shall be subjected to preliminary operation and testing by the Contractor before the individual facilities and systems are put into operation. Tests shall be made to determine whether the equipment has been properly assembled, aligned, adjusted, wired and connected. Any changes, adjustments, or replacement of equipment which are due to errors or omissions on the part of the Contractor, or which may be otherwise necessary to comply with the requirements of this Contract, shall be done without additional cost to the Owner. Upon completion of the checking and adjustment, the Contractor shall demonstrate that each separate piece of equipment in each system of related items of mechanical equipment and the related instrumentation and control equipment operate in accordance with the requirements of the Contract Specifications. Where no specific performance requirements are stated in the Specifications, the test shall show that the equipment operates in accordance with normal application practice of the equipment. The demonstration test shall show that the equipment operates smoothly and without excessive noise or vibration, that the equipment is responsive to manual and automatic controls, that control and protective devices are properly set, that the equipment will run continuously when continuous operation is intended, and that the equipment will run on a controlled or intermittent basis when this operation is intended. The demonstration test for each piece of equipment shall include check out from each remote control point. All alarm systems and safety lockout systems shall also be demonstrated for proper function along with all process instrumentation and controls.

The demonstration test shall be arranged by the Contractor who shall notify the Engineer not less than 3 days in advance of the date of the test. The Contractor shall provide personnel from the various trades involved to operate and demonstrate the equipment.

15. SYSTEM START-UP:
The Contractor shall place the various items of equipment into operation, along with the related piping and metering systems, and shall notify the Engineer at least three days in advance of the date of start-up.

Schedule for such start-up of the majority of the equipment and pumping systems will occur during the duration of the Contract period and prior to final completion and acceptance of the overall
project. After satisfactory start-up of these individual systems, including all of the related equipment, they will remain in continuous or intermittent operation as required.

All equipment and accessories shall be adjusted and calibrated prior to any start-up as specified under these Special Conditions. Any equipment placed into temporary operation prior to final completion of the total project shall be re-adjusted and/or calibrated.

The Contractor shall supervise, control, and be responsible for the operation and maintenance of the new equipment and/or system during a period of at least 10 days after each individual item is placed into operation. The Contractor shall furnish an adequate number of competent start-up personnel to provide supervision during these phases. The Contractor shall remain responsible for making any required changes, repairs or replacements to the new installation during this period.

16. INSTRUCTION OF OWNER'S EMPLOYEES:

The Contractor shall provide competent personnel who fully understand the operation of the equipment to instruct the Owner's employees in the operation and maintenance of each item and system. Such instruction shall take place prior to acceptance of the installation by the Owner at such a time or times that are acceptable to the Owner. The Contractor shall include the cost of this training in the bid price for this Contract. Training shall be of the on-the-job type, and shall cover all areas of operation and equipment maintenance. The training program shall be for a minimum of 2 days of 8 hours each. Training shall be done by a factory or maintenance representative of the various items of equipment.

Scheduling of instruction of the Owner's employees will be mutually agreed upon between the Owner, Contractor and the Engineer.

17. SHOP/WORKING AND CONSTRUCTION DRAWING - SUBMITTALS:

The Contractor shall submit to the Engineer a complete schedule of data on materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive material, such as catalogs, cuts, diagrams, performance curves and charts published by the manufacturer, to show conformance to specification and drawings requirements; model numbers alone shall not be acceptable.

Each individual submittal item for materials and equipment shall be marked to show Specification Section and paragraph number which pertains to the item.

The purpose of shop drawing submittals is to demonstrate to the Engineer that the Contractor understands the design concept. The Engineer’s review of such drawings, schedules, or cuts shall not relieve the Contractor from responsibility for deviation from drawings or Specifications unless he has, in writing, called the Engineer’s attention to such deviation at the time of submission, and has received from the Engineer, in writing, permission for such deviations.

Shop drawings shall be stamped by the Engineer with the following classifications:

1) No Exceptions Taken.
No corrections, no marks. Contractor shall submit copies for distribution.

2) **Make Corrections Noted.**
   A few minor corrections. Items may be ordered as marked up without further resubmission. Submit corrected copies for distribution.

3) **Amend and Resubmit.**
   Minor corrections. Item may be ordered at the Contractor’s option. Contractor shall resubmit drawings with corrections noted.

4) **Rejected-Resubmit.**
   Major corrections or not in accordance with the Contract Documents. No items shall be ordered. Contractor shall correct and resubmit drawings.

   Corrections to shop drawings shall not relieve the Contractor from the obligation to complete the project within the time allowed by the Contract Documents.

   The Contractor shall submit shop or working drawings of concrete reinforcement, structural details, piping layout, wiring, materials fabricated especially for this project, materials for which drawings are specifically requested, and equipment. The Contractor shall also submit structural shop drawing, computations and construction procedures for jacking pits, sheeted trenches and cofferdams to be used in construction.

   Such drawings shall show the principal dimensions, the weight, structural and operating features, space required, clearances, etc., depending on the subjects of the drawing. When it is customary so to do, or when the dimensions are of particular importance, the drawings shall be certified by the manufacturer as correct for this project.

   No material shall be purchased or fabricated for equipment or other features until the Engineer has reviewed the shop or working drawings. All materials and work involved in the construction shall then be represented by said drawings.

   No work shall be done upon the foundations or any other part of a structure of which the design or construction is dependent upon the design of equipment or other features for which review is required until such review has been completed.

   **Six (6) copies** (unless otherwise specified) of all shop or working drawings shall be submitted to the Engineer through the Contractor. Only drawings which have been checked and corrected by the material fabricator shall be submitted. The Contractor shall be responsible for the prompt submission of all shop or working drawings so that there shall be no delay to the work due to the absence of such drawings. Additional prints or drawings shall be furnished as required.
The review of shop and working drawings, etc., will be general and shall not relieve the Contractor from the responsibility for details of design, dimensions, etc., necessary for proper fitting and construction of the work required by the contract.

The Contractor shall furnish prints of all construction drawings in duplicate to the Engineer, who will retain one set and return the other, having marked thereon such changes as he may suggest. Examination, suggestions and review by the Engineer of drawings or other data submitted to him pursuant to the provisions of this paragraph shall relate only to the apparent fitness of the items thus explained as an aid in producing the general result which is the purpose of the contract. The Engineer’s examination, suggestions and review will not be directed, and shall not be understood to relate to the strength, adequacy or sufficiency of such things, which are and will remain solely the responsibility of the Contractor. At the completion of all construction and subsequent modifications, the Contractor shall prepare and deliver to the Engineer six copies of all previously submitted preliminary and shop drawings, each modified to include all subsequent additions and revisions that were made during construction. These said six copies will be identified as AS-BUILT SHOP DRAWINGS.

The Contractor shall furnish the Engineer, during the progress of the work, as many prints of all construction drawings as may be required for construction purposes.

The Contractor shall not order any material until the submitted detail drawings have been reviewed. If the Contractor departs from this procedure for his own convenience, such departure shall be at his own risk and expense, if any. The Contractor shall also give the Engineer notice, stating the quantity of material ordered and the location of the mill and shop where the material will be rolled and fabricated.

18. OPERATING INSTRUCTION MANUALS:
The Contractor shall prepare and submit six copies of a complete set of operating instructions for the overall project and covering all equipment and systems furnished. Operating instructions shall be prepared specifically for each system installed under this Contract and shall consider the specific equipment and controls included. Operating instructions shall be complete for each separate system, and shall detail start and stop procedures and shall explain all safety devices and detail procedures and precautions for restarting after failure or safety lockout situations.

Two copies of operating instruction shall be submitted to the Engineer for review with the shop drawings for the equipment and shall be resubmitted with corrections and additional personnel information prior to the period of personnel training.

19. MAINTENANCE INSTRUCTION MANUALS:
The contractor shall prepare and submit six (6) copies of a complete set of maintenance instruction manuals for the overall project and covering all equipment furnished. Manuals shall include complete parts lists for all equipment and recommended spare parts. Manuals shall be prepared specifically for the particular equipment furnished and shall consider the specific operation of this equipment in the particular process system involved. Complete lubrication requirements shall be listed, including recommended lubricant and lubricating intervals or schedule.
Two copies of the above shall be submitted on a preliminary basis for review by the Engineer with the shop drawings for the equipment. Final submittal of Maintenance Manuals shall be received prior to any equipment start-up.

20. DIVISION OF WORK:
Division of work as made by the Contract Plans and Specifications is for the purpose of specifying all work which is required. There is no attempt to make complete classification according to trade or any agreements which may exist between Contractors or groups of Contractors and trade union. Such division and classification of the work shall be the Contractor's responsibility.

21. RESTORATION:
The Contractor shall conduct his operations so that restoration of roadways, driveways, curb and gutter, ditches and easements progresses along with the work. If the Engineer determines that inadequate progress is being made with the restoration, he may shut down the Contractor's pipe laying operation until the restoration is caught up with the pipe installation.

Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed to those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

22. EXISTING UTILITIES:
All known utility facilities are shown schematically on the plans and are not necessarily accurate in location as to plan or elevation. Utilities such as service lines or unknown facilities not shown on the plans will not relieve the Contractor of his responsibility under this requirement except as noted below. "Existing Utility Facilities" means any utility that exists on the project in its original, relocated or newly installed position.

The Contractor shall contact all owners of utilities including gas companies, electric companies, telephone companies, cable television companies and governmental units prior to starting any excavation on the project and shall request that they locate and mark their respective facilities.

The Contractor will not be held responsible for the cost of repairs to damaged underground facilities, other than service lines from the street mains to abutting property, when such facilities are not shown on the plans or the utility does not properly locate its lines and their existence is unknown to the Contractor prior to damages occurring, provided that the Engineer determines that the Contractor has otherwise fully complied with the Specifications. Payment for the cost of repairs will be as defined in Article 4 of the General Conditions.

23. DELAY AND EXTENSION OF TIME:
If the Contractor is delayed at any time in the progress of the work by an act of neglect of the Owner or his employees or by any other Contractor employed by the Owner, or by changes ordered
in the work, or by strikes, lockouts, fire, unusual delay in transportation, unavoidable casualties or any cause beyond the Contractor's control, or by any cause which the Engineer shall decide to justify the delay, then the time for completion shall be extended for such reasonable time as the Engineer may decide.

Delays resulting from site conditions unforeseen by the Owner and Contractor, errors or omissions in the Plans or Specifications (such omissions as lines not shown or incorrectly shown), and which cause an interruption in the orderly progress of the work, while awaiting a decision for change in the work, relocation of the utility or other corrective action by persons other than the Contractor's forces shall be justification for an extension of the Contract time except where the total elapsed time resulting from such delay is less than four hours. Delays exceeding four hours in length shall result in an extension of a minimum of one day. Time extensions will not be granted, however, in cases where the Contractor is able, without undue hardship, to shift his work crew to other productive work on the same project, in the same general work area.

Nothing herein shall relieve the Contractor from making reasonable and careful investigation of site conditions.

Remobilization - In the event conditions arise as set forth above that necessitate a Contractor to move his work force away from the job site, he will after notice from the Engineer, have five days to remobilize his work force. Time charges will resume when the work force returns or at the end of five days, whichever is sooner.

Notice of such delay shall be made in writing to the Engineer not more than thirty days after occurrence of such delay. Otherwise, no extension will be granted during the life of the Contract for such delay.
24. MAINTENANCE DURING CONSTRUCTION:

The Contractor shall maintain the work from the beginning of construction operations until final acceptance of the project. This maintenance shall constitute continuous and effective work prosecuted day by day with adequate equipment and forces to the end that the site and structures thereon are kept in satisfactory condition at all times, including satisfactory signing or marking as appropriate and control of traffic where required by use of traffic control devices as required by the State in which this project is located.

Upon completion of the work, the Contractor shall remove all construction signs and barriers before final acceptance of the Project.

While undergoing improvements, the roads shall be kept open to all traffic by the Contractor. The Contractor shall keep the portion of the Project being used by public traffic, whether it be through or local traffic, in such condition that traffic will be adequately accommodated. The Contractor shall bear all cost of signs and markings as required and other maintenance work during construction and before the Project is accepted and of constructing and maintaining such approaches, crossings, intersections, and other features as may be necessary without direct compensation.

25. FAILURE TO MAINTAIN ROADWAYS AND STRUCTURES:

If, at any time, the Contractor fails to properly maintain roadways and structures, the Engineer will immediately notify the Contractor of such non-compliance. If the Contractor fails to remedy the unsatisfactory maintenance within 48 hours after receipt of such notice, the Engineer may immediately arrange for maintenance of the work, and the entire cost of this maintenance will be deducted from monies due or to become due the Contractor under the Contract. As an alternative to the Engineer's maintaining the work, all the items and quantities of work done, but not properly maintained, may be deducted from the current progress estimate, even if such items have been paid for in a previous estimate.

26. FLAGGING TRAFFIC:

Competent, courteous, and neat flagmen shall be provided and available at all times when required. A sufficient number of flagmen shall be provided to stop traffic, advise the public of delays occasioned, and keep traffic in their respective lanes along the Project. Red flags, not less than 24 inches by 24 inches and mounted on a staff at least 36 inches long may be substituted for paddles in emergency situations only. Flagmen will wear high visibility colored hat and vest while flagging.

27. BARRICADES, DANGER, WARNING & DETOUR SIGNS:

The Contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient lights, danger signals, signs and other traffic control devices, and shall take all necessary precautions for the protection of the work and safety of the public. Highways and streets closed to traffic shall be protected by effective barricades, and obstructions shall be lighted during hours of darkness. Suitable warning signs shall be provided to properly control and direct traffic.

The Contractor shall furnish, install, and maintain all necessary barricades, warning signs, and other protective devices in accordance with the State requirements in which the project is located.

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located. Temporary signs may be reused, provided they are in good condition and legible. All protective devices shall be kept in a good, legible condition while in use.

As soon as construction advances to the extent that temporary barricades, and signs are no longer needed to inform the traveling public, such signs shall be promptly removed.

The cost of furnishing, erecting, maintaining, and removing protective devices will not be paid for as a separate Bid Item. Where the Contractor is required to perform any of these functions, the cost thereof shall be included in the overall Bid submitted. Ownership of the temporary warning devices shall remain with the Contractor provided the devices are removed promptly after completion of the work as specified above. If such warning devices are left in place for more than 30 days after the specified time for removal, the Owner shall have the right to remove such devices and to claim possession thereof.

Reflectorization for Construction Signing shall conform to the requirements of the State Department of Transportation Standard Specifications.

28. **RETAINAGE TO BE HELD ON SUPPLIERS:**
   The Contractor shall withhold a ten percent retainage on the invoice amounts of all major equipment items until the respective suppliers have satisfactorily started-up their equipment and it has been in satisfactory operation for a period of 90 days. All supplier/manufacturer field calibrations, operator orientation, and other necessary adjustments shall be completed and the equipment's operation deemed acceptable prior to the Contractor's release of the retainage.

29. **DIFFERING SITE CONDITIONS:**
   The Contractor shall promptly, and before such conditions are disturbed, notify the Engineer in writing of: 1) subsurface or latent physical conditions differing materially from those indicated in this Contract, or 2) unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Contract. The Engineer shall promptly investigate the conditions, and if he finds that such conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the work under this Contract, whether or not changed as a result of such conditions, an equitable adjustment shall be made and the Contract modified in writing accordingly.

30. **HIGH VOLTAGE ACT:**
   The Contractor acknowledges the requirement of the High Voltage Power Line Safety Act of the General Assembly of South Carolina by execution of this Contract.
31. **REFERENCED SPECIFICATIONS:**
   Reference to the Department of Transportation Standard Specifications is to current South Carolina Department of Transportation Standard Specifications as appropriate.

32. **DRAWINGS:**
   The work shall conform to the drawings, all of which form a part of these specifications and are available in the office of TPM:

33. **PAYMENTS TO CONTRACTOR:**
   Progress estimates and payments shall be in accordance with of the General Conditions and the final estimate and payment shall be in accordance with the General Conditions, except as otherwise hereinafter provided.

   The requirements of the Prompt Payment Act shall be waived. Payment to the Contractor for progress estimates and the final estimate shall require approximately 60 calendar days after submission to the Owner. The Contractor shall make any arrangements necessary to accommodate this payment schedule.

34. **RETAINAGE:**
   Retainage shall be 10 percent of the gross value of the completed work as may be provided for in the contract; provided, however, that no additional amounts shall be retained on estimates or progress payments submitted after 50 percent of the work on the project has been completed if in the opinion of the Owner and/or his representative such work is satisfactory and has been completed on schedule. This will not affect the retained amounts on the first 50 percent of the work on the project which may continue to be held to ensure satisfactory completion of the project. If, after discontinuing the retainage, the Owner and/or representative determine that the work is unsatisfactory or has fallen behind schedule, retainage may be resumed at the previous level.

   Retainage shall be invested at the current market rate and any interest earned on the retained amount by the Owner shall be paid to the contractor when the project has been competed within the time limits specified and for the price specified in the contract, or in any amendments or change orders approved in accord with the terms of the contract.
Final payment of the retained amounts to the contractor under the contract to which the retained amounts relate shall be made after certification by the Engineer in charge of the project covered by the contract. Payment to the contractor of interest earned on the retained amounts shall be made after certification by the Engineer in charge of the project covered by the contract that the work has been completed within the time specified and within the price specified in the contract.

At substantial completion of the work and as the Owner’s authorized representative determines the work to be reasonably satisfactory, the Owner shall within 30 days after invoice and other appropriate documentation, as may be required by the contract documents, are provided pay the retainage to the contractor. If at that time there are any remaining incomplete minor items, an amount equal to 200 percent of the value of each item as determined by the Owner’s representative shall be withheld until such item or items are completed.

35. PERMITS:
The Owner has obtained the required South Carolina Department of Transportation permits, which are hereby incorporated into this contract. The contractor shall comply with all terms, conditions and requirements of the permits.

36. TAX EXEMPTION
Owner is exempt from payment of sales and compensating use taxes of the State of South Carolina and of cities and counties thereof on materials to be incorporated into the Work.

Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of materials and equipment to be incorporated into the Work.

Owner’s exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to materials and equipment not incorporated into the Work.

37. RECORD DATA:
Complete “record data” information shall be submitted by the Contractor to the Engineer along with the final pay request. “Record data” information shall include elevations of tops and inverts of all sanitary sewer structures and length and size of all pipes, location of all structures, valves, hydrants and service laterals. Final payment shall not be approved prior to the Engineer receiving the required “record data” information from the Contractor.

38. INSURANCE:
Add the following new paragraph to the General Conditions immediately after paragraph 5.04B:

C. The limits of liability for the insurance required by paragraph 5.04 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:
1. Worker’s Compensation, and related coverages under paragraphs 5.04.A.1 and A.2 of the General Conditions.
   a. State: Statutory
   b. Applicable Federal (e.g., Longshoreman’s): Statutory
   c. Employer’s Liability Statutory

2. Contractor’s General Liability under paragraphs 5.04.A.3 through A.6 of the General Conditions which shall include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody and control of the Contractor:
   a. General Aggregate $1,000,000
   b. Products - Completed Operations Aggregate $1,000,000
   c. Personal and Advertising Injury $1,000,000
   d. Each Occurrence (Bodily Injury and Property Damage) $1,000,000
   e. Property Damage liability insurance will provide Explosion, Collapse, and Underground coverages where applicable.
   f. Excess or Umbrella Liability
      1) General Aggregate $1,000,000
      2) Each Occurrence $1,000,000

3. Automobile Liability under paragraph 5.04.A.6 of the General Conditions:
   a. Bodily Injury:
      Each person $1,000,000
      Each accident $1,000,000
   b. Property Damage: Each Accident $1,000,000
   c. Combined Single Limit of $1,000,000
4. The Contractual Liability coverage required by paragraph 5.04.B.4 of the General Conditions shall provide coverage for not less than the following amounts:

a. Bodily Injury:

   Each Accident          $1,000,000
   Annual Aggregate       $1,000,000

7b. Property Damage:

   Each Accident          Included above
   Annual Aggregate       Included above

39. EQUIPMENT VENDORS:
    This project has been designed based on the Lakeside Septage Receiving Station. The Huber RotoFAS is also an acceptable vendor for this project. Any modifications necessary for the siting of the Huber equipment are to be included in the Contractor’s bid proposal.

40. Huber RotoFAS Modification:

1. Section 3.02 Control Panel to include:

4. Panel heater with thermostat.
19. The control panel shall accept a dry contact from the Chopper Pump Control Panel to initiate a start sequence for flows from the Owner’s Vacuum Truck and log as such in the management software.
20. The control panel shall provide a permissive contact to the Chopper Pump Control Panel to allow pumping to begin.
21. When the Chopper Pump shuts off the Septage Receiving System shall close the valve and begin the shutdown sequence.

2. Section 3.03 Hauler Access Station to include:

8. Provide copper to fiber media converter (100Base-FX) to accept multimode fiber with ST connectors to interface with the plant computer network. Panel shall include any required power supplies for converter.
41. Lakeside 40SAP Septage Acceptance Plant

1. Section 2.07 - E to include:

19. Panel heater with thermostat.
20. The control panel shall accept a dry contact from the Chopper Pump Control Panel to initiate a start sequence for flows from the Owner’s Vacuum Truck and log as such in the management software.
21. The control panel shall provide a permissive contact to the Chopper Pump Control Panel to allow pumping to begin.
22. When the Chopper Pump shuts off the Septage Receiving System shall close the valve and begin the shutdown sequence.

2. Section 2.09 to include:

J. Provide copper to fiber media converter (100Base-FX) to accept multimode fiber with ST connectors to interface with the plant computer network. Panel shall include any required power supplies for converter.

42. Vaughan Chopper Pump

1. Item 3 – Op Services – Simplex Control Panel to include:

a. 10hp, 480V Simplex Control Panel in NEMA 4X 316 stainless steel enclosure with:
   1. Aluminum inner door
   2. Main pump/breaker
   3. NEMA size 1 starter
   4. 500 va 480 – 120 vac transformer fused on primary and secondary
   5. Phase failure/voltage protection relay
   6. Lightning arrester
   7. Elapsed time meter
   8. HOA switch
   9. Green LED “On” light
   10. Float control for On/Off and High Level
   11. Alarm light and horn with silence button
12. 3 Anchor Scientific 80-foot long N.O. floats

b. Price shall include approval and As-Built drawings and one (1) day of start up

c. Control panel shall include a “call-to-run” contact to initiate the Septage Receiving System start sequence prior to the pump starting, the Septage Receiving System will provide a “permissive” dry contact to allow the pump to start.

d. The Control Panel shall include a Septage Receiving Station Override switch to manually run the pump permissive dry contact for testing.

e. The panel shall include the following dry contacts: Running (2 sets), Pump Alarm, and High Level.
SECTION 01150
MEASUREMENT AND PAYMENT

A. **SCOPE:**
Under this heading shall be included the methods of measurement and payment for items of work under this Contract.

B. **ESTIMATED QUANTITIES:**
All estimated quantities for unit price items, stipulated in the Bid Proposal, or other Contract Documents, are approximate and are to be used as a basis for estimating the probable cost of the work and for comparing the bids submitted for the Project. The actual amounts of work done and materials furnished under price items may differ from the estimated quantities. The basis of payment for work and materials will be the actual amount of work done and material furnished. The Contractor agrees to make no claim for damages, anticipated profits or otherwise on account of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts included in the Bid Proposal. The Contractor will not be paid for any work which exceeds 25 percent of the quantity set forth in the Bid Schedule without a change order issued before the work is performed unless specifically ordered in writing by the Engineer. The Contractor will provide assistance to the Engineer to check quantities and elevations when so requested.

**Item 1&2 – Base Bid Equipment:** For furnishing all equipment necessary for construction of the North Charleston Septage Station. Bid Proposal to be awarded based on Base Bid equipment pricing. The Owner will determine the final equipment to be incorporated into the project.

**Item 3 – Lump Sum Pay Item:** For furnishing all materials and equipment and performing all labor necessary for construction of the North Charleston Septage Station and all other work and appurtenances necessary for completion of the work under this contract, complete (except work in Section II), as shown on the Drawings and/or specified.

END OF SECTION 01150
SECTION 02220

EARTHWORK - STRUCTURAL (WITHIN 5 FEET OF STRUCTURE)

PART1 – GENERAL

1.1 SUMMARY

A. This Section specifies earthwork to occur within the perimeter of the structure footprint, including, but not necessarily limited to, footings, foundations, and slab base. All soil preparation shall be in accordance with these.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 2 Section Grading
2. Division 2 Section Earthwork

1.2 BENCHMARKS

A. Establish and maintain a minimum of two corresponding benchmarks on the site for references. All vertical dimensions shall be checked from these benchmarks.

1.3 FINISH GRADES

A. Finished grades, as used herein, are the final grade elevations indicated on the drawings. Should finished grades shown on spot elevations conflict with those shown by the contours, the spot elevations shall govern.

1.4 BORROW PITS

A. Submit representative samples of all fill material requiring compaction to the Designated Testing Laboratory. Material and borrow pits shall be approved by the Architect and Engineer prior to filling operations. If the quantity available from site grading is not sufficient, the purchasing, hauling, and blending of fill shall be done by the Contractor.

1.5 CONTROLLED FILL

A. Class I Fill is all Structural Fill to the underside of slabs, mat foundation under in-ground tanks, and to support foundations or footings and fill below finish grade immediately behind walls and in trenches and embankments under walks, drives, parking areas, and all areas to be paved.
1.6 DESIGNATED TESTING LABORATORY

A. Designated Testing Laboratory shall be selected and paid by the Owner.

B. Designated Testing Laboratory shall:

1. Witness proof rolling and make recommendations concerning undercutting and surface scarification.
2. Observe and make recommendations concerning surface drainage.
4. Provide advice concerning the selection of borrow soils.
5. Evaluate the suitability of the subgrade soils at the foundation bearing level as it relates to the geotechnical report for the project.
6. Submit daily testing reports to the Engineer.
7. Perform observation of placement and compaction of structural fill.

1.7 COMPACTION TESTING

A. Class I Fill: Two Field Density Test (ASTM D2922 - Nuclear Method, D1556 – Sand Cone Method, or D2937 - Drive Cylinder Method) for each 1,000 SF of Structure Area after each 8-inch loose lift (unless noted otherwise in the Geotechnical Report) of fill with a minimum of 2 per lift; one auger and cone penetrometer test per 75 lineal feet of Grade Beam Subgrade. Provide two auger and cone penetrometer tests, to a minimum depth of 5 feet if possible with groundwater and soil conditions, for every 1,000 SF of equipment pad slab or in-ground tank mat-foundation subgrade as a minimum.

1.8 INSUFFICIENT FILL MATERIAL

A. If the quantity of grading material is insufficient to provide finish grade elevations indicated on drawings, the Contractor shall obtain additional fill material of specified quality off-site at no additional cost to the Owner.

1.9 EXCESS CUT MATERIAL

A. If the quantity of grading material is in excess of quantities to provide finish grade elevations indicated on drawings; any excess material shall be deposited off-site at no additional cost to the Owner.

PART 2 - MATERIAL

2.1 FILL MATERIAL UNDER STRUCTURE FOOTPRINT

A. Sand Fill material shall consist of clean sand with a fineness modulus of 1.6 to 3.1
and contain no more than 10% by weight finer than No. 200 U.S. Standard Sieve.

B. Earth Fill material shall be free of organics, deleterious material, debris, and rocks greater than 3 inches. Earth Fill shall be classified as GM, GC, GP, SM, SP, SW, SC, or CL by ASTM D2487-85 Standard Methods for Classification of Soils for Engineering Purposes. Earth Fill shall also conform to the following:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Liquid Limit</td>
<td>40 maximum</td>
</tr>
<tr>
<td>2. Plasticity Index</td>
<td>20 maximum</td>
</tr>
<tr>
<td>3. Dry Unit Weight Density</td>
<td>100 pcf minimum</td>
</tr>
</tbody>
</table>

C. Pervious Stone material shall consist of crushed stone or gravel. Size and gradation shall be as specified herein below:

| Total Percent Passing Sieve (By Weight): |
|---------------------|--------|--------|--------|--------|--------|--------|
| Square Sieve        | 1-1/2” | 1”     | 3/4”   | 2”     | 3/8”   | #4     | #8     |
|                     | 100    | 100    | 100    | 90-100 | 40-70  | 0-15   | 0-5    |

PART 3 - EXECUTION

3.1 SITE GRADING

A. The contractor shall perform all filling, backfilling, cutting, and rough grading necessary to bring the entire area both inside and outside of structures, and under the floor slabs, to elevations indicated on the drawings.

B. Finish grading outside of the structure, where not shown otherwise on the drawing, shall be given uniform slopes between points for which finished grades are shown, or between points and existing established grade.

C. Provide drainage away from the structure, where not shown otherwise on the drawings, at a grade of at least 6 inches in 10 feet. Provide shallow swales where indicated on plans at a minimum width of 6 feet and a minimum depth of 3 inches with a minimum flowline grade of not less than 1/8 inch per foot. Provide rounding at the top and bottom of banks and at other breaks in grade.

D. Remove unsuitable material, dispose of off-site at no additional cost to the owner, and replace it with Structural Fill.

E. Do not drain downspouts adjacent to footings.

3.2 RAINWATER, SURFACE WATER, AND BACK-UP

A. Protect all work, including excavations and trenches, from rainwater, surface
water, and back-up of drains and sewers. Furnish all labor, pumps, shoring, enclosures, and equipment necessary to protect and to keep work free of water.

3.3 PROOFROLLING

A. Demolish and remove asphalt from the building site.

B. After stripping and stockpiling of surficial organic soils per specifications, and prior to footing excavation, the newly exposed subgrade enclosed by a line drawn 5'-0" outside the building shall be proofrolled.

C. Proofrolling shall consist of systematically trafficking the area, in perpendicular directions, utilizing a heavily loaded dump truck or similar equipment (20 tons minimum).

3.4 INSPECTION OF SUBGRADE

A. Soft, loose, organic, old non-engineered fill or unstable surface zones which are detected during proof rolling shall be scarified and compacted or be undercut to suitable material and backfilled. Request instructions from the Architect.

B. Stockpile undercut materials by Fill Material classifications in on-site locations where it will not interfere with construction operations. Materials stockpiled shall be placed in a manner to afford drainage. Protect against erosion.

C. Replace undercut material with a Class I fill.

3.5 INSTALLATION OF CLASS I FILL

A. Class I Fill shall be Earth Fill material except backfill immediately behind walls and under the floor slabs and mat foundations for in-ground tanks, as indicated on drawings shall be Sand Fill or Pervious Stone.

B. Compact within +/- 3% of optimum moisture in 8-inch loose lift layers to a density equivalent to 98% of the Standard Proctor Maximum (ASTM D698).

3.6 INSTALLATION OF BACKFILL

A. Shore Foundation Walls which are to be tied into floor slabs prior to installation of backfill and until slabs have been in place sufficient time to achieve strength and provide structural stability against overturning.

B. Where backfill is required on both sides of the walls, it shall be brought up in even layers so as to provide an equal lateral load.
C. Install backfill against foundation walls only when directed by the Engineer and elsewhere as construction progress permits. Fill adjacent to walls shall be compacted using a hand-operated pneumatic or mechanical tamper. Restrict vehicular traffic within a distance from the wall equal to the wall height as a minimum.

3.7 EXCAVATION

A. Excavate to elevations and dimensions, plus space to permit the erection of forms and for waterproofing and installation of drains. All bottoms shall be clean-cut, true, level, and sound. Any loosened soil exposed at the bottom of the excavations shall be removed or compacted to a density equivalent to 98% of the Standard Proctor Maximum (ASTM D698). Any water softened soils in foundation excavations shall be removed prior to steel and concrete placement. At no extra cost to the Owner, carry foundation concrete to the bottom of any excavation erroneously carried too deep, unless noted otherwise in the Geotechnical Report. If excavation is to be left overnight during inclement weather, place a 2000 psi mud mat at the bottom of the excavation.

B. For the excavation of pipes or conduit under the slab or mat foundation, install backfill in 8" to 12” loose lifts compacting each lift to 98% of the Standard Proctor Maximum (ASTM D698). Backfill shall be Earth Fill material.

C. If suitable bearing for foundations is not encountered at the depth indicated on the drawings, the contractor shall notify Engineer and shall not proceed with any work until instructions are given and necessary measurements made to establish the additional volume of excavation, compacted fill and/or concrete.

D. At excavations adjacent to existing foundations or footings, the Contractor shall not remove lateral support from any existing footing or foundation without first underpinning or protecting the footing or foundation against settlement or lateral translation. The Contractor is solely responsible for determining if the removal of the existing soil may remove lateral support from the existing foundations. The method of underpinning or bracing of the existing foundation or footing is the responsibility of the Contractor. Excavation below existing foundations shall not occur without the approval of the Architect unless shown on the plans.

END OF SECTION 02220
PART 1 - GENERAL

1.01 SUMMARY
This section specifies the requirements for excavation, trenching, and backfilling for all underground utility systems. Underground utility systems include water mains and services, sanitary sewers and services, storm drains, and sanitary sewer force mains.

1.02 RELATED SECTIONS
Section 02200 - Earthwork

PART 2 - MATERIALS

2.01 BEDDING
A. Bedding material shall meet the following requirements:

1. Coarse sands and gravels with maximum particle size of 40 mm (1.57 inches), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry.

2. Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures.

2.02 BACKFILL
A. Backfill material shall consist of suitable excavated materials or imported gravel meeting the requirements of #57 stone.

B. All backfill material shall be free of stones, concrete and clay lumps larger than a cubic foot. Roots, stumps and rubbish which will decompose will not be permitted in the backfill. Backfill material shall have its moisture content corrected, as may be necessary before being placed in the trench to bring the moisture content to approximately "optimum" for good compaction. Any rock, stone, concrete, clay lumps larger than a cubic foot in volume, rubbish and debris shall be removed from the site and properly disposed of by the Contractor.
PART 3 - EXECUTION

3.01 GENERAL
Underground piping and utility systems which are to be installed in trenches whose lowest point of excavation is below the existing ground level and are unaffected by an excavation for structures, may be installed at any time during the course of the work. Piping and systems to be installed in or over fill, backfill or new embankments shall not be installed until all earthwork has been completed to rough grade, nor until settlement of the fill or embankment has taken place.

3.02 LOCATION AND PROTECTION OF UTILITIES AND STRUCTURES

A. It shall be the responsibility of the Contractor to acquaint himself with the location of all utilities and structures both present and proposed, also all existing surface structures which may be affected by work under the Contract. The location of any underground structures furnished, shown on the Drawings or given on the site are based upon the available records but are not guaranteed to be complete or correct, and are given only to assist the Contractor in making a determination of the existence of underground structures.

B. Overhead utilities, poles, etc., shall be protected against damage by the Contractor, and if damaged by the Contractor, shall be replaced by him. The Contractor shall notify those who maintain utilities sufficiently in advance of the proposed construction so that they may locate, uncover and disclose such work. If the progress of construction necessitates the removal or relocation of poles, overhead utilities and obstructions, the Contractor shall make all arrangements and assume all costs of the work involved.

C. The Contractor shall provide for the continuance of the flow of any sewers, drains, water pipes, and water courses, and the like. Where such facilities, water courses, or electric overhead wires or conduits are interfered with by the work of the Contractor, the interruption shall be a minimum and shall be scheduled in advance with the Engineer and the utility owner.

D. The Contractor shall restore all facilities interfered with to their original condition or acceptable equivalent. The cost of such restoration or damage caused directly by his work shall be paid for by the Contractor and shall be included in the prices bid for the items to which it pertains.

3.03 EXCAVATION AND TRENCHING

A. Excavation
Excavate all materials encountered. See Section 02200 for additional requirements.
B. Caution in Excavation
The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures in the trench zone may be determined before being damaged. He shall be held responsible for the repair or replacement of such structures when broken or otherwise damaged because of his operations.

C. Trench Excavation
Trenches shall be wide enough to permit proper installation of pipe fittings and placing and compacting bedding and backfill materials. The width of the trench shall be sufficient to accommodate compaction equipment. Whenever possible, the clear width of the trench at the top of the pipe should not exceed the pipe outside diameter plus 24 inches.

D. Alignment and Grade
Trenches shall be excavated on the alignments shown on the Drawings, and to the depth and grade necessary to accommodate the pipes at the elevations shown. Where elevations of the invert or centerline of a pipe are shown at the ends of a pipe, the pipe shall be installed at a continuous grade between the two elevations.

E. Over Excavation
Excavation in excess of the depth required for proper shaping shall be corrected by bringing to grade the invert of the ditch with compacted coarse, granular material at no additional expense to the Owner. Bell holes shall be excavated to relieve bells of all load, but small enough to insure that support is provided throughout the length of the pipe barrel.

Excavation in excess of the depths required for manholes and other structures shall be corrected by placing a sub-foundation of 1500 psi concrete, at no additional expense to the Owner.

F. Rock Excavation
Rock found in trench shall be removed for a depth of at least six (6) inches below the bottom of the pipe.

3.04 SHEETING AND SHORING
Excavations, shall be properly shored, sheeted and braced by the Contractor to maintain excavation in a condition to permit the safe and efficient installation of all items of Contract work. Braced and sheeted trenches and open trenches shall comply with all state laws and regulations, and local ordinances relating to safety, life, health and property. Also, this shall conform to the Occupational Safety and Health Standards for Excavations, Final Rule (29 CFR Part 1926) as printed in the October 31, 1989 issue of the Federal Register.
3.05 DEWATERING AND PROTECTION AGAINST WATER

A. The Contractor shall remove water from the site and shall lower the ground water level as necessary to complete the excavations to the required depths and so that all required work can be accomplished in the dry. The Contractor shall perform well construction, well pointing, sheeting, ditching, and pumping, and shall construct necessary drains, channels and sumps to keep his excavations and new structures clear of ground water, storm water or sewage and to keep his construction areas dry during the progress of the Work.

B. Adequate measures and protection shall be provided by the Contractor to protect his work from damage from uplift due to ground water, storm water, or flood water. Any damages which may result due to dewatering shall be the Contractor's responsibility.

C. All water discharged by pumping operations shall be discharged so as not to interfere with work under this Contract or with existing structures and operations. Water from dewatering operations shall be conveyed to the existing drainage features, using piping and pumping facilities provided by the Contractor. Route of dewatering pipe shall be subject to the Engineer's review. Discharge facilities and water quality shall comply with applicable regulations of State and Federal agencies.

D. Dewatering operations shall be uninterrupted and continuous during the course of the work so as not to endanger any construction in place or to present a hazard to workmen in and around the site. The Contractor shall take all measures necessary including, but not limited to, standby equipment and constant attendance to ensure that the dewatering system remains operational and effective throughout the period of time that it is required.

E. No water shall be allowed to run over any uncompleted portions of the work. No units of the work shall be constructed under water. The cost of dewatering shall be included in the price bid for the item of work for which it is required.

3.06 REMOVAL AND REPLACEMENT OF UNSUITABLE FOUNDATION MATERIAL

A. When the trench is excavated to the plan depth or as required by these Specifications, and soft or other material not suitable for bedding purposes is encountered in the trench, the Contractor shall immediately notify the Engineer for inspection and measurement of the unsuitable material to be removed. Where, in the opinion of the Engineer, the subgrade of the pipe trench is unsuitable material, the Contractor shall remove the unsuitable material to a depth of 6” for the full
width of the trench and furnish and place stone backfill in the trench to stabilize the subgrade. Payment for removal and replacement of unsuitable material shall be in accordance with the requirements of the Measurement and Payment Section.

B. Attention is invited to the fact that the presence of water does not necessarily mean that stone backfill is required. If well points or other types of dewatering will remove the water, the Contractor shall be required to completely dewater the trench in lieu of stone backfill. Removal and replacement of unsuitable material with stone backfill will be limited to areas where well pointing and other conventional methods of dewatering will not produce a dry bottom.

C. No payment will be made for any overdepth excavation of soft unstable material due to the failure of the Contractor to provide adequate means to keep the trench dry.

D. No payment will be made for any overdepth excavation of the unsuitable material and replacement not inspected and measured by the Engineer prior to excavation.

3.07 PLACEMENT OF BEDDING MATERIALS

A. Bedding material shall be placed and compacted up to the springline of the pipe.

B. Bedding material around the pipe shall be installed with care. Care shall be used to insure that sufficient material has been worked under the haunch of the pipe to provide adequate side support. Precautions must be taken to prevent movement of the pipe during placing of the material through the pipe haunch.

C. Avoid contact between the pipe and compaction equipment. Compaction of bedding shall be done so that compaction equipment will not damage the pipe.

D. ASTM D2321 "Underground Installation of Flexible Thermoplastic Sewer Pipe" shall be used in conjunction with the above.

3.08 PLACEMENT OF BACKFILL MATERIAL

A. Backfilling operations in this work are referred to herein as Backfilling at the Pipe Zone, Type "A" and Type "B". Type A backfilling shall be used where trenches cross under roadways, paved areas, and structures. Type B backfilling shall be used in all other areas.

B. Type "A" backfill shall consist of suitable excavated materials or imported gravel or soil placed in the trench in 6 inch thick layers from one foot above the pipe to finished grade. Each 6-inch layer shall be compacted before additional material is placed in the excavation. The density of the backfilled material after compaction shall be equal to 100 percent of the maximum density obtainable at optimum moisture content as determined by the Standard Proctor Test (ASTM D698). No
water shall be used to secure compaction except for adding water to the backfill material before placing in the trench to bring moisture content to approximately "optimum" for good compaction.

C. Type "B" Backfilling shall consist of suitable excavated materials or imported gravel or soil placed in the trench in 12 inch thick layers from the spring line of the pipe to finished grade. Each 12 inch thick layer shall be compacted before additional backfill material is placed in the excavation. The density of the backfilled material after compaction shall be equal to 95 percent of the maximum density obtainable at optimum moisture content as determined by the Standard Proctor Test (ASTM D698). Water shall be added to backfill material only before being placed in the trench in order to bring the moisture content to approximately "optimum" for good compaction.

3.09 CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS

A. Operations
Excavation, trenching and backfilling along highways, streets and roadways shall be in accordance with the applicable regulations of the State Highway Department with reference to construction operations, safety, traffic control, road maintenance and repair.

B. Removing And Resetting Fences
Where existing fences must be removed to permit construction, the Contractor shall remove such fences. As construction progresses, reset the fences in their original location and to their original condition. All costs of removing and resetting fences and such temporary works as may be required shall be included in the prices for the utility line or as provided for in the Bid Proposal.

C. Protecting Trees, Shrubbery And Lawns
Trees and shrubbery along trench lines shall not be disturbed unless absolutely necessary. Trees and shrubbery necessary to be removed shall be properly heeled-in and re-planted. Heeling-in and re-planting shall be done under the direction of an experienced nurseryman. Where utility trenches cross established lawns, sod shall be cut, removed, stacked and maintained in suitable condition until replaced.

Topsoil underlying lawn areas shall likewise be removed and kept separate from general excavated materials. Removal and replacement of sod shall be done under the direction of an experienced nurseryman.

D. Protection of Traffic
Provide suitable signs, barricades and lights for protection of traffic, in locations where traffic may be endangered by construction operations. All signs removed by reason of construction shall be replaced as soon as condition which necessitated such removal has been cleared. No highway, street or roadway shall
be closed without first obtaining permission from the proper authorities.

E. Drainage Structures
All side ditches, culverts, cross drains and other drainage structures shall be kept clear of excavated material and be free to drain at all times.

F. Maintaining Highways, Streets, Roadways and Driveways
The Contractor shall furnish proper equipment which shall be available for use at all times for maintaining highways, streets and roadways. All such streets, highways and roadways shall be maintained in suitable condition until completion and final acceptance of the work.

The Contractor shall repair all driveways that are cut or damaged and maintain them in suitable condition until completion and final acceptance of the work.

3.10 PROTECTION OF WATER SUPPLY PIPES

A. Parallel Installation
Water mains shall be laid at least ten (10) feet horizontally from any existing or proposed sanitary sewer, storm sewer or sewer manhole. The distance shall be measured edge to edge. When local conditions prevent a horizontal separation of 10 feet, the water main maybe laid closer to a sewer (on a case-by-case basis) provided the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. The sewer materials and joints shall be the equivalent to water main standards of construction and be pressure tested as required in Section 02700 to assure water-tightness.

B. Crossing
Water mains crossing sewers, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer. At the crossings, one full length of water pipe shall be located so that both joints will be as far apart as possible. When local conditions prevent a vertical separation of 18 inches, the sewer passing over or under the water mains shall be constructed of materials and with joints that are equivalent to water mains standards of construction and shall be pressure tested as required in Section 02700 to assure water-tightness.

C. Special Conditions
When water mains cross under sewers, additional measures shall be taken by providing:

1. A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main;
2. That the one full length of water pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer; and, special structural support for the water and sewer pipes be installed if required.

3. Both the sewer and the water main shall be constructed of water pipe materials and subjected to hydrostatic test, as prescribed in Section 02700 - Water Distribution System and/or Section 02712 – Sanitary Sewer Force Mains. Encasement of the water pipe in concrete shall also be considered.

3.11 REMOVE AND REPLACE PAVEMENT

A. Pavement and base course which must be removed for constructing sewers, manholes, force mains, water lines, and all other appurtenances in streets shall be replaced as specified in Section 02500.

B. The top 18 inches of subgrade material immediately under the paving base and also road shoulder shall be carefully removed and kept separate from the rest of the excavated material. This material shall be placed in the top 18 inches of the backfill. Further compaction shall be accomplished by leaving the backfilled trench open to traffic while maintaining the surface with crushed stone or gravel. Settlement in trenches shall be refilled with crushed stone or gravel, and such maintenance shall continue until replacement of pavement.

C. Where utility lines are constructed on unpaved streets, roads or easements, the top 18 inches of soil shall be stripped and windrowed separate from the excavation from trenches. After the line has been installed and the backfill completed within 18 inches of the original grade, the salvaged surfacing shall be replaced. This work shall be considered as general clean-up along with the removal of surplus excavated materials from the site and the restoring of the surface outside trench limits to its original condition, the cost of which shall be included in the price bid for the utility line.

3.12 WALKS, DRIVES, CONCRETE CURB AND GUTTER

A. Walks, driveways, and concrete curb and gutter designated for removal or are damaged during the course of construction shall be replaced in accordance with Section 02520, and the Standard Drawings.

B. Sidewalks, driveways, and concrete curb and gutter shall be removed by making a vertical saw joint between any existing sidewalk, driveway, or curb and gutter that is to remain in place and the portion that is to be removed. The subgrade shall be compacted in accordance with the requirements of Section 02200. Concrete shall
be placed in accordance with Section 02520.

3.13 TESTING

A. General
The Contractor shall select a qualified independent testing laboratory, acceptable to the Engineer, for the purpose of identifying soils, checking densities, and classifying soils materials during construction. All testing will be paid for by the Contractor. Copies of all test results shall be furnished to the Engineer.

B. Moisture-Density Tests
Testing shall be in accordance with ASTM Methods D698 or other tests acceptable to the Owner. A test shall be performed on each type of material used in the work regardless of source. Tests will be accompanied by particle-size analyses of the soils tested (ASTM Methods D421 and D422). Changes in color, gradation, plasticity or source of fill material will require the performance of additional tests. Copies of all test results shall be furnished to the Engineer.

C. Field Density Tests
Tests shall be made in accordance with ASTM Method D1556 or other tests acceptable to the Owner. Tests shall be made in accordance with the following minimum schedule or as required by the soils technician or as may be directed by the Engineer:

One test for each lift of backfill for each 200 feet of trench or fraction thereof.

D. Submittals

1. The soils technicians will submit formal reports of all compaction tests and retests.

2. The reports are to be furnished to the Owner and the Engineer as soon as possible upon completion of the required tests.

3. This report information is to include but not be limited to the following:
   a. Date of the test and date submitted.
   b. Location of test.
   c. Wet weight, moisture content and dry weight of field sample.
   d. Description of soil.
   e. Maximum dry density and moisture content of the lab sample.
which best matches the field sample in color, texture, grain size and maximum dry density.

f. Ratio of field dry density to maximum lab dry density expressed as a percentage.

g. Comments concerning the field density passing or failing the specified compaction.

h. Comments about re-compaction if required.

E. Compaction Results

1. If any compaction test reveals that fill or backfill is not compacted as specified, the Contractor shall scarify and re-compact as required to achieve the specified density. Additional compaction tests shall be made to verify proper compaction. These additional tests, required due to failure of the original test shall be paid for by the Contractor.

2. The soils technician is to advise the Engineer and the Contractor's Superintendent immediately of any compaction tests failing to meet the specified minimum requirements. No additional lift is to be placed on a lift with any portion failing.

END OF SECTION 02221
PART 1 - GENERAL

1.01 SCOPE
Under this heading shall be included the furnishing and installation of base course and pavement as shown including subgrade preparation, base course and pavement.

1.02 RELATED SECTIONS
Section 02200 - Earthwork
Section 02221 - Excavation, Trenching and Backfill for Utility Systems

1.03 GENERAL
Subgrade preparation shall include leveling, compacting and proof-rolling of the subgrade as required. Installation of the base course shall include the placing and compacting of the material with appropriate equipment. Pavement shall be placed as shown on the plans with the necessary equipment and shall include any prime coats or tack coats required. All work shall be in conformity with the lines, grades and typical cross-sections shown on the Plans. The Contractor must have all equipment and workers on the job site necessary to perform a given operation when it is initiated.

1.04 SUBGRADE PREPARATION
The subgrade shall be brought to the line and grade necessary to accommodate the base and pavement at the required finished grades. Subgrade shall be completely compacted in accordance with the requirements of Section 02221. All subgrade shall be proof-rolled as specified, before base course is placed on the subgrade.

PART 2 - MATERIALS

2.01 BASE COURSE

A. Preparation of Base
The surface of the base course will be inspected by the Engineer for adequate compaction and surface tolerances specified in applicable base course or sub-base course. Any ruts or soft yielding spots that may appear in the base course, any areas having inadequate compaction, and any deviations of the surface from the requirements specified for the base course shall be corrected by loosening the affected areas, by removing unsatisfactory material and adding approved material where required, and by reshaping and recompacting to line and grade and to the specified density requirements. Compaction of base material shall be done by conventional means using a 30,000 to 40,000 pound vibratory roller or other
means of obtaining the required compaction.

The lines and grades shown on the Contract Drawings for each pavement category of the Contract shall be established and maintained by means of line and grade stakes placed at the site of the work by the Contractor.

B. Graded Aggregate Base Course

The aggregate in the base course shall consist of a mixture of either crushed gravel, together with sand, sand-gravel, soil or other materials having similar characteristics combined as necessary to give a mixture conforming to the requirements, prescribed herein. The material and installation shall meet the requirements of Section 310 of the State Department of Transportation Standard Specifications.

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Percent by Weight Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot;</td>
<td>100</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>97-100</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>60-90</td>
</tr>
<tr>
<td>No. 10</td>
<td>25-45</td>
</tr>
<tr>
<td>No. 60</td>
<td>5-30</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-15</td>
</tr>
</tbody>
</table>

C. Limerock Base Course.

At the Contractor's option limerock of either Miami or Ocala formation may be used, but limerock of only one formation may be used on any contract.

The minimum percentage of carbonates of calcium and magnesium in the limerock material shall be 70. The maximum percentage of water sensitive clay material shall be 3.

The liquid limit shall not exceed 35 and the material shall be non-plastic.

Limerock material shall not contain cherty or other extremely hard pieces, or lumps, balls or pockets of sand or clay size material in sufficient quantity as to be detrimental to the proper bonding, finishing, or strength of the limerock base.

At least 97 percent (by weight) of the material shall pass a 1-1/2 sieve and the material shall be graded uniformly down to dust. The fine material shall consist entirely of dust of fracture. All crushing or breaking up which might be necessary in order to meet such size requirements shall be done before the material is placed on the road.
2.02 BITUMINOUS PRIME
Bituminous prime shall be cutback asphalt RC-70 applied at the rate of 0.20 gallons per square yards. The material and application rate shall comply with Section 412 of the State Department of Transportation Standard Specifications.

2.03 BITUMINOUS TACK COAT
The bituminous tack coat shall be an asphaltic material which meets the requirements of Section 413 of the State Department of Transportation Standard Specifications. Application rate shall be at the rate indicated in the appropriate section on the plans or as shown on Detail P-10 "Typical Pavement Section".

2.04 PAVEMENT FABRIC
Fabric used for underlayment shall be equivalent to Phillip's Petromat.

2.05 BITUMINOUS PAVEMENT
The bituminous wearing surface shall be a plant mix conforming to the requirements of Section 400 of the State Department of Transportation Standard Specifications. The job mix shall meet the requirements of 9.5mm or 12.5mm Superpave, Section 828 of the State Department of Transportation Standard Specifications and shall have a Marshall Stability of 1500 pounds (50 blow) and a percent voids between 4 and 5.

A job mix formula indicating the single definite percentage for each sieve fraction of aggregate and for asphalt shall be submitted prior to surfacing operations. The job mix formula shall also show the stability as determined by the Marshall Method, the percent voids, the percent voids filled with asphalt, and the unit weight per cubic foot of compacted mix.

The general composition limits are extreme ranges of tolerances to govern mixtures made from any raw materials meeting the specifications. The submission of the job mix formula shall bind the Contractor to furnish paving mixture meeting the exact formula within allowable tolerances of plus or minus 1/2 percent for asphalt, plus or minus 7 percent of 1/2 inch and larger sieve sizes, plus or minus 5 percent for material passing the 1/2 inch thick sieve and retained on the No. 200, and plus or minus 1/2 percent of material passing the No. 200.

Compaction shall be done with an 8 to 10 ton steel-wheeled roller or other means approved by the Engineer. Thickness shown on the Drawings is a minimum. Smoothness shall not exceed one-eighth inch for a ten foot straight edge.

2.06 TRAFFIC STRIPING
Unless specifically approved otherwise by the NCSD, all pavement markings and traffic striping on pavement to be accepted by the NCSD shall be thermoplastic. When approved, or on private property, markings may be painted. All thermoplastic
or paint shall conform to the applicable sections of the State Department of Transportation specifications. The color and pattern shall be as shown on the drawings.

PART 3 - EXECUTION

3.01 TESTING

A. The following tests will be made in accordance with the current edition of the appropriate Department of Transportation Standard Specifications or otherwise directed by the NCSD or their representative. All testing shall be by a certified laboratory approved by the NCSD.

1. Sub-grade compaction shall be one (1) test per 500 square yards, 100% Standard (ASTM D-698).

2. Base and pavement shall be cored for thickness at points determined in the field by the NCSD or it representative and at a minimum of 2 per 500 LF (one on edge and one on centerline w/ edge alternating) square yards or a minimum of two (2) per project. In areas of thickness deficiency, additional cores shall be taken as directed by the NCSD. Deficient areas, once fully defined shall be remediated to the satisfaction of the NCSD without recourse.

3. At least one density determination shall be made for each 1,000 square yards of base. Asphalt extraction and aggregate gradation on the asphaltic concrete plant mix: one for each 200 tons of material, or fraction thereof, delivered to the job site. In-place density of the compacted base will be determined in accordance with the Sand Cone Method, ASTM D-1556 or Nuclear Method, ASTM D-2922.

4. Surface finish of the completed base shall not show any deviation in excess of ¼-inch when tested with a 10-foot straight edge. Deviation in thickness of the base shall be up to but not including 3/8-inch of the required thickness.

5. Striping width shall not be less than the specified width. No stripe shall exceed the specified width by more than ½-inch. The alignment of the stripe shall not deviate from the intended alignment by more than one inch on tangents and on curves up to and including one degree. On curves exceeding one degree, the alignment of the stripe shall not deviate from the intended alignment by more than 2-inches.

3.02 PROOF-ROLLING

Proof-rolling will be done with a loaded tandem dump truck (15 yards heaped) or as
specified in the Department of Transportation Standard Specifications. Test rolling will be done parallel to the centerline at speeds between 2 and 5 miles per hour; 3 to 4 passes depending on width of road shall be completed prior to final walk along proof roll.

END OF SECTION 02500
PART 1 - GENERAL

1.01 SCOPE:

A. The work of this section consists of furnishing all materials, labor, equipment and incidentals required and performing all the painting necessary to complete this Contract in its entirety.

B. It is the intent of these Specifications to paint all exposed concrete, masonry, miscellaneous metal, pipe, fittings, supports, valves, equipment, pre-engineered metal buildings and all other work obviously required to be painted except as otherwise specified. Minor items omitted in the schedule of work shall be included in the work of this Section where they come within the general intent of the specifications as stated herein.

C. The following surfaces or items are not required to be painted:

1. Portions of metal, other than aluminum, embedded in concrete. This does not apply to the back face of items mounted to concrete or masonry surfaces which shall be painted before erection. Aluminum to be embedded in or in contact with concrete or masonry shall be coated to prevent electrolysis.

2. Stainless steel.

3. Finish hardware and door closures.

4. Manhole frames and covers.

5. Fiberglass other than piping and doors.

6. Packing glands and other adjustable parts and nameplates of mechanical equipment.
1.02 REFERENCES:

A. Steel Structures Painting Council (SSPC)
B. American Association of State Highway and Transportation Officials (AASHTO).
C. Occupational Safety and Health Act (OSHA).

1.03 SUBMITTALS:

A. Submit to the Engineer for review in accordance with Section 01500, or drawings, working drawings, and product data including manufacturer's specifications and data on the proposed paint systems and detailed surface preparation, application procedures and dry film thickness.

B. Submit to the Engineer for review in accordance with Section 01500, color cards, including standard and special colors, for initial color selections. The Owner will select all final paint colors to be used on this project.

C. Schedule of Painting Operations: Submit to the Engineer for review a complete Schedule of Painting Operations within 90 days after the Notice to Proceed. This schedule is imperative so that the various fabricators may be notified of the proper shop prime coat to apply. Properly notify and coordinate the fabricators' surface preparation and painting operations with these Specifications. This Schedule shall include for each surface to be painted, the brand name, the percent volume of solids, the coverage and the number of coats the Contractor proposes to use in order to achieve the specified dry film thickness, and color charts. When the Schedule has been approved, apply all material in strict accordance with the approved Schedule and the manufacturer's instructions. Wet and dry paint film gauges shall be made available to the Engineer to verify the proper application while work is in progress.

1.04 PRE-PAINTING CONFERENCE:

A. Well in advance of commencement of painting operations, but after major equipment has been delivered, a pre-painting conference shall be held. All parties with an interest in the painting work shall attend including the Contractor, the Manufacturer, the Owner, the Engineer, and the painting subcontractor and his foreman. The Contractor shall contact each party and arrange the meeting.

B. The conference shall include an inspection of the areas to be painted by all parties and discussion of the conformance of each area with the specifications. Important issues such as environmental conditions climate control systems, original primer dry film thickness, and monitoring the number of coats that have been field applied shall be discussed and problems shall be resolved.

C. A written record of the meeting shall be submitted to the Engineer.
1.05 PAINT STORAGE SAFETY PRECAUTIONS:

A. The area selected for paint storage and mixing must have good natural or mechanical ventilation. It shall be posted as a "no smoking area" and this regulation strictly enforced.

B. Paints, turpentines, spirits, thinners and all other inflammable liquids shall be kept in closed metal containers. Brushes and rollers left in solvent or brush cleaner must be kept in closed containers.

C. There shall be no open containers of any inflammable liquids including paint left in the storage or mixing area. Waste, rags, paper and similar combustible material shall be placed in metal containers provided with self-closing covers. These containers are to be emptied regularly and the contents removed from the premises.

D. Where paint is applied in confined or enclosed areas proper ventilation and equipment shall be provided for worker's safety.

E. All paints shall be properly prepared by the manufacturer and delivered to the site for field painting in the original unbroken containers with manufacturer's label plainly printed thereon. Each container shall provide labels with following information: Name or title of material; manufacturer's name; contents by volume for major pigment and vehicle constituents; date of manufacture; thinning instructions; and application instructions.

F. Type of material to be applied at each location shall be submitted to the Engineer with the manufacturer's written recommendation of the type paint for each item to be painted.

G. Containers which are broken, opened, water-marked and/or contain caked, lumpy, or otherwise damaged materials, are unacceptable and shall immediately be removed from the work site.

H. The Contractor shall exercise every precaution in the storing of paints, solvents, cleaning fluids, rags, and similar materials as to eliminate the risk of spontaneous combustion or other hazardous conditions. Portable fire extinguishing equipment shall be provided in a convenient location for emergency access. All painting materials stored on the job site shall be stored in a location outside of the work area. The Contractor shall take all safety precautions in accordance with Section 7 of AWWA D-102, NFPA Bulletin No. 101 and all federal, state and local regulations.
PART 2 - PRODUCTS

2.01 MATERIALS:

A. Materials shall be delivered at the site in the original containers bearing manufacturer's labels, with labels intact and seals unbroken. All mixing and tinting shall be done on the premises and no materials shall be reduced or changed, except as specified by the manufacturer of the material.

B. No materials shall be delivered at the site, except such as have been approved by the Engineer as to manufacture, brand and quality.

C. Each paint and finish shall be the manufacturer's best grade of the kind called for, and each shall be suitable for the use required and over the primer used.

D. The full names of manufacturers that are designated by abbreviations in the Systems Schedule are as follows:

1. Tnemec (T)
2. Induron (I)
3. Sherwin Williams

E. See also the General and/or Special Conditions on substitutions and "or equals."

F. All paint which may come in contact with the water being treated shall be U.S. Environmental Protection Agency (EPA) approved for use with potable water. Contractor shall furnish three (3) copies of an affidavit from manufacturers that the paint materials are approved by the U.S. EPA for contact with potable water.

2.02 COLOR AND FINISHES:

Except as otherwise specified, colors shall be selected by the Owner. Submit samples as directed for selection and approval. The finished work shall be in accordance with approved samples in each case. Samples of finish shall be about 6 inches x 18 inches and shall be on materials similar to those to be finished in each case. See article hereinafter on piping, etc.
**2.03 PAINTING AND FINISHING SCHEDULE:**

A. Painting Schedule:

<table>
<thead>
<tr>
<th>SURFACE</th>
<th>PAINT SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete walls &amp; ceilings as indicated on the drawings.</td>
<td>A</td>
</tr>
<tr>
<td>Concrete block walls not otherwise shown or specified.</td>
<td>B</td>
</tr>
<tr>
<td>Miscellaneous metal, ferrous, interior.</td>
<td>C</td>
</tr>
<tr>
<td>Miscellaneous metal, ferrous, exterior.</td>
<td>D</td>
</tr>
<tr>
<td>Wood trim</td>
<td>F</td>
</tr>
<tr>
<td>Door frames and misc. metals.</td>
<td>G</td>
</tr>
<tr>
<td>Hollow metal doors, frames and panels.</td>
<td>H</td>
</tr>
<tr>
<td>Gypsum board walls</td>
<td>I</td>
</tr>
<tr>
<td>Gypsum board ceilings</td>
<td>J</td>
</tr>
<tr>
<td>Process equipment &amp; piping, all ferrous parts located below fluid level or subject to splash.</td>
<td>K</td>
</tr>
<tr>
<td>Electric panelboards.</td>
<td>K</td>
</tr>
<tr>
<td>Process equipment &amp; piping, all ferrous parts, including bridges, etc., above fluid level &amp; not subject to splash.</td>
<td>L</td>
</tr>
<tr>
<td>Previously painted process equipment &amp; piping, all ferrous parts located below the fluid level or subject to splash.</td>
<td>M</td>
</tr>
<tr>
<td>Previously painted process equipment &amp; piping, all ferrous parts located above the fluid level &amp; not subject to splash.</td>
<td>N</td>
</tr>
<tr>
<td>Stainless steel and aluminum.</td>
<td>No Paint</td>
</tr>
<tr>
<td>Process &amp; other piping not insulated.</td>
<td>P</td>
</tr>
<tr>
<td>Insulated piping &amp; ducts.</td>
<td>Q</td>
</tr>
<tr>
<td>Surface Type</td>
<td>Paint System</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Interior concrete surfaces of channels, splitter boxes, pre aeration tanks, MBR tanks and wetwells.</td>
<td>W</td>
</tr>
<tr>
<td>Exterior concrete surfaces (above grade).</td>
<td>X</td>
</tr>
<tr>
<td>Exterior masonry surfaces.</td>
<td>X</td>
</tr>
<tr>
<td>Interior concrete floors &amp; stairs. No Paint</td>
<td>No Paint</td>
</tr>
<tr>
<td>Aluminum doors. No Paint</td>
<td>No Paint</td>
</tr>
<tr>
<td>Conduit, aluminum No paint, except may be painted same as walls &amp; ceilings where surface mounted</td>
<td>P</td>
</tr>
</tbody>
</table>

**B. Finishing Schedule**

1. **SYSTEM A**: 2 Coats T-Series 180 or I-AC 230 applied at a minimum dry film thickness of 4.0 - 8.0 mils per coat. Total dry film thickness 8.0 - 16.0 mils.

2. **SYSTEM B**: 1 Coat T-54-562 Masonry Filler or I-AC 220 Acrylic Block Filler applied at a square foot coverage of 60 to 80 sq. ft per gallon and 1 Coat T-Series 113 or I-AC 303 Acrylic Epoxy applied at a minimum dry film thickness of 4.0 - 8.0 mils. Total dry film thickness (excluding filler) not less than 4.0 mils.

3. **SYSTEM C**: Touch-up Shop Coat T-Series 135 or I-Induramastic-85, plus: 2 Coats T-Series 113 or I-AC 303 Acrylic Epoxy applied at a minimum dry film thickness of 4.0 - 8.0 mils per coat. Total dry film thickness 8.0 - 16.0 mils.

4. **SYSTEM D**: Touch-up Shop Coat T-Series 135 or I-Induramastic-85, plus: 1 Coat T-Series 66 Hi-Build Epoxoline or I-Armorguard Epoxy applied at a minimum dry film thickness of 3.0 - 5.0 mils. 1 Coat T-Series 73 or I-Indurethane 5500 applied at a minimum dry film thickness of 2.0 - 3.0 mils. Total dry film thickness 5.0 - 8.0 mils.

5. **SYSTEM F**: 1 Coat T Series 36-603 Undercoater or I-AC 301 Wood Primer or P-Series 17-21 applied at minimum dry film thickness 2.0 – 3.0 mils and 2 Coat T Series 2H Tneme-Gloss or I-Armorlux 2500 or P-Series 95 applied at a minimum dry film thickness of 1.5 – 2.0 mils per coat. Total dry film thickness 5.0 – 7.0 mils.
6. **SYSTEM G:** Touch-up Shop Coat T-Series 135 or I-Induramastic-85, plus: 2 Coats T-Series 66 Hi-Build Epoxoline or I-Armorguard Epoxy applied at a minimum dry film thickness of 2.0 - 3.0 mils per coat. Total dry film thickness 4.0 - 6.0 mils. If exterior exposed, 1 Coat T-Series 73 or I-Indurethane 5500 applied at a minimum dry film thickness of 2.0 - 3.0 mils. Total dry film thickness 6.0 - 9.0 mils.

7. **SYSTEM H:** Touch-up Shop Prime Coat, plus: 2 Coats T-Series 2H Gloss or I-Armorlux 2500 applied at a minimum dry film thickness of 1.5 - 2.0 mils per coat. Total dry film thickness 3.0 - 4.0 mils.

8. **SYSTEM I:** 1 Coat T-Series 51-792 PVA Sealer or I-AC 210 Masonry Sealer applied at a minimum dry film thickness of 1.0 - 2.0 mils and 2 Coats T-Series 6 Tnemec-Cryl or I-AC 230 Acrylic Eggshell applied at a minimum dry film thickness of 2.0 - 3.0 mils per coat. Total dry film thickness 5.0 - 8.0 mils.

9. **SYSTEM J:** 1 Coat T-Series 51-792 PVA Sealer or I-AC 210 Masonry Sealer applied at a minimum dry film thickness of 1.0 - 2.0 mils and 2 Coats T-Series 6 Tnemec-Cryl or I-AC 230 Acrylic Eggshell applied at a minimum dry film thickness of 2.0 - 3.0 mils per coat. Total dry film thickness 5.0 - 8.0 mils.

10. **SYSTEM K:** Surface preparation as required by coating manufacturer except not less than Commercial Blast (SSPC-SP6) for Non-Immersion service and Near-White Blast (SPCC-SP10) for Immersion service. Primer is to be shop applied by equipment manufacturer except where noted, but must be compatible with finish coats to be applied under this section, and shall be:

    1 Coat T-Series 66 Hi-Build Epoxoline or I-PE-54 Epoxy Primer applied at a minimum dry film thickness of 3.0 - 5.0 mils.

    After erection apply:

    1 Coat T-Series 66 Hi-Build Epoxoline or I-Armorguard Epoxy applied at a minimum dry film thickness of 4.0 - 6.0 mils. Total dry film thickness 7.0 - 11.0 mils.

11. **SYSTEM L:** Surface preparation as required by coating manufacturer except not less than Commercial Blast (SSPC-SP6) for Non-Immersion service and Near-White Blast (SPCC-SP10) for Immersion service. Primer is to be shop applied by equipment manufacturer except where noted, but must be compatible with finish coats to be applied under this section, and shall be:

    1 Coat T-Series 66 Hi-Build Epoxoline or I-PE-54 Epoxy Primer applied at a minimum dry film thickness of 3.0 - 5.0 mils.

    After erection apply:
1 Coat T-Series 66 Hi-Build Epoxoline or I-Armorguard Epoxy applied at a minimum dry film thickness of 4.0 - 6.0 mils. Total dry film thickness 7.0 - 11.0 mils.

12. SYSTEM M: Surface preparation as required by coating manufacturer except not less than Commercial Blast (SSPC-SP6) for Non-Immersion service and Near-White Blast (SPCC-SP10) for Immersion service. Primer is to be shop applied by equipment manufacturer except where noted, but must be compatible with finish coats to be applied under this section, and shall be:

1 Coat T-Series 66 Hi-Build Epoxoline or I-PE-54 Epoxy Primer applied at a minimum dry film thickness of 3.0 - 5.0 mils.

After erection apply:

1 Coat T-Series 66 Hi-Build Epoxoline or I-Armorguard Epoxy applied at a minimum dry film thickness of 4.0 - 6.0 mils. Total dry film thickness 7.0 - 11.0 mils.

13. SYSTEM N: Surface preparation as required by coating manufacturer except not less than Commercial Blast (SSPC-SP6) for Non-Immersion service and Near-White Blast (SPCC-SP10) for Immersion service. Primer is to be shop applied by equipment manufacturer except where noted, but must be compatible with finish coats to be applied under this section, and shall be:

1 Coat T-Series 66 Hi-Build Epoxoline or I-PE-54 Epoxy Primer applied at a minimum dry film thickness of 3.0 - 5.0 mils.

After erection apply:

1 Coat T-Series 66 Hi-Build Epoxoline or I-Armorguard Epoxy applied at a minimum dry film thickness of 4.0 - 6.0 mils. Total dry film thickness 7.0 - 11.0 mils.

14. SYSTEM O: Stenciling and signs, only, as specified elsewhere in this section.

15. SYSTEM P: 2 Coats T-Series 66 Hi-Build Epoxoline or I-Armorguard Epoxy applies at a minimum dry film thickness of 3.0 - 5.0 mils (1st Coat) and 4.0 - 6.0 mils (2nd Coat). Also color coding and stenciling and signs as specified elsewhere in this section. Total dry film thickness 7.0 - 11.0 mils. **Process piping colors shall be in accordance with the Water Environment Federation (WEF) Plant Piping Color Code.**

16. SYSTEM Q: 2 Coats T-Series 6-Tnexec-Cryl or I-AC 230 Acrylic Eggshell applied at a minimum dry film thickness of 2.0 - 3.0 mils per coat. Also, if
process piping stenciling and signs as specified. Total dry film thickness 4.0 - 6.0 mils.

17. SYSTEM W: Surface preparation per coating manufacturer’s instructions, 2 Coats T-Series 66 Hi-Build Epoxoline or I-Armorguard Epoxy applied at 4.0 - 6.0 mils per coat. First coat to be spray applied and back rolled. Total dry film thickness 8.0 - 12.0 mils. The pre aeration and MBR tanks do not require painting.

18. SYSTEM X: Surface preparation per Section 03300 for new concrete surfaces. Existing concrete and masonry surfaces shall be wire brushed or "water-blasted" and otherwise prepared per the coating manufacturer's instructions. The surfaces shall be finished 2 Coats T-Series 156 EnviroCrete or I-AC 403 Elastomeric applied at a minimum dry film thickness of 4.0 - 6.0 mils per coat. First coat to be spray applied and back rolled. Total dry film thickness of 8.0 -12.0 mils. If surface has been previously painted, a tie-coat of T-Series 151 or I-AC 210 Masonry Sealer is required prior to applying T-Series 156 EnviroCrete or I-AC 403 Acrylic Elastomeric.

19. SYSTEM Y: Concrete Tanks, Interior NSF/ANSI Std.61. Surface Preparation: SSPC-SP13/NACE 6, ICRI CSP 5. Filler/Surfacer Epoxy modified epoxy mortar Tnemec series 218 applied at 1/16” to 1/8”. Prime Coat: Tnemec series N140-1255 applied at a 4.0-6.0 mils DFT. Finish Coat: Tnemec series 406-WH-06 Applied at 30-40 mils DFT.

2.04 COLOR CODING FOR PIPES AND EQUIPMENT:

A. When color coding is specified, it shall consist of color code painting and identification of all exposed conduits, trough items and pipelines for the transport of gases, liquid and semi-liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and all operating accessories which are integral to be whole functional mechanical pipe and electrical conduit system. Colors shall be selected by the Owner.

B. All hangers and pipe support floor stands shall be painted the same color and with the same paint as the pipe it supports. The system shall be painted up to but not including the flanges attached to the mechanical equipment nor the flexible conduit connected to electrical motors. When more than one pipe system is supported on the same bracket, the bracket shall be painted the same color as the adjacent wall or ceiling. Colors shall be selected by the Owner.

C. All systems which are an integral part of the equipment, that is originating from the equipment and returning to the same piece of equipment, shall be painted between and up to but not including, the fixed flanges or connections on the equipment.
D. The color code establishes, defines and assigns a definite color for each category of pipe. All colors are assigned by the Owner and shall be treated as an integral part of the Contract.

E. Banding for pipes shall be as specified by the Owner. Bands shall be 2 inches wide and spaced at 2 feet on center.

2.05 LETTERING OF TITLES:

A. Each pipe system shall be labeled with the name of the materials in each pipeline and alongside this an arrow indicating the direction of flow of liquids. Titles shall be as so described in attached schedule. Titles shall not be located more than 20 linear feet apart and shall also appear directly adjacent to each side of any wall the pipeline breaches, adjacent to each side of the valve regulator, flowcheck, strainer cleanout, and all pieces of equipment.

B. Titles shall identify the contents by complete name. Identification title locations shall be determined by the Engineer but in general they shall be placed where the view is unobstructed and on the two lower quarters of pipe or covering where they are overhead. Title should be clearly visible from operating positions especially those adjacent to control valves.

C. Titles on equipment shall be applied at eye level on machines where possible or at the upper most broad vertical surface of low equipment. Where more than one piece of the equipment item to be titled exists, the items shall be numbered consecutively as indicated on the mechanical drawings or as directed by the Engineer; for example Pump No. 1, Pump No. 2, etc. Titles shall be composed and justified on the left hand side as follows:

Pump No. 1

D. Application of titles.

1. The color of the titles shall be black or white as approved, to best contrast with the color of the pipes and equipment and shall be stencil applied.

2. Stencil text is to be in ALL CAPS worded exactly as shown in the Schedule. Titles are to be printed in a single line.

3. Letter sizes.

<table>
<thead>
<tr>
<th>Outside Diameter of Pipe or Covering (inches)</th>
<th>Size of Legend Letters (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾ to 1¼</td>
<td>½</td>
</tr>
<tr>
<td>1½ to 2</td>
<td>¾</td>
</tr>
</tbody>
</table>

09900 - 10
4. Equipment titles are to be two inches high.

5. Arrow sizes. Where "a" is equal to ¾ of outside diameter of pipe or covering, the arrow shaft shall be 2 "a" long by ⅜ "a" wide. The arrow head shall be an equilateral triangle with sides equal to "a." Maximum "a" dimension shall be 6 inches.

6. When using direction arrows, point arrowhead away from pipe markers and indirection of flow. If flow can be in both directions, use a double-headed directional flow.

2.06 METAL TAGS:

For pipelines smaller than ¾-inch in diameter, securely fasten metal tags, 2½ inches x ½-inches, of 17 Birmingham Stubs Gage Brass with lettering etched and filled with enamel. Tags shall be approved by the Engineer.

2.07 FABRICATED EQUIPMENT:

A. Unless otherwise indicated all fabricated equipment shall be shop primed and shop or field finished.

B. All items to be shop primed shall be thoroughly cleaned of all loose material prior to priming. If, in the opinion of the Engineer, any prime coating shall have been improperly applied or if material contrary to these Specifications shall have been used, that coating shall be removed by sandblasting to white metal and reprimed in accordance with the Specifications.

C. All shop prime coats shall be of the correct materials and applied in accordance with these Specifications. Remove any prime coats not in accordance with these Specifications by sandblasting and apply the specified prime coat at no additional cost to the Owner.

D. Shop primed surfaces shall be cleaned thoroughly and damaged or bare spots retouched with the specified primer before the application of successive paint coats in the field.

E. Be responsible for and take whatever steps are necessary to properly protect the shop prime and finish coats against damage from weather or any other cause.

F. A shop finish coat shall be equal in appearance and protection quality to a field applied finish coat. If, in the opinion of the Engineer, a shop finish coat does not
give the appearance and protection quality of other work of similar nature, prepare the surfaces and apply the coat or coats of paint as directed by the Engineer to accomplish the desired appearance and protection quality. Submit to the Engineer substantial evidence that the standard finish is compatible with the specified finish coat.

G. Wherever fabricated equipment is required to be sandblasted, protect all motors, drives, bearings, gears, etc., from the entry of grit. Any equipment found to contain grit shall be promptly and thoroughly cleaned.

PART 3 - EXECUTION

3.01 PREPARATION OF SURFACES:

A. The Contractor is wholly responsible for the finish of all work. All surfaces to be painted shall be prepared as specified herein and shall be dry and clean before painting. Special care shall be given to thoroughly clean interior concrete and concrete block surfaces of all marks before application of finish.

B. All metal welds, blisters, etc., shall be ground and sanded smooth in accordance with SSPC-SP-3 or in difficult and otherwise inaccessible areas by hand cleaning in accordance with SSPC-SP-2. All pits and dents shall be filled and all imperfections shall be corrected so as to provide a smooth surface for painting. All rust, loose scale, oil, grease and dirt shall be removed by use of approved solvents, wire brushing or sanding.

C. Concrete surfaces shall have been finished as specified in Division 3. Report unsatisfactory surfaces to the Engineer. Concrete shall be free of dust, oil, curing compounds, and other foreign matter.

D. Concrete block surface shall be smooth and cleaned of all dust, efflorescence, chalk, loose mortar, dirt, grease, oil, tar and other foreign matter.

E. All plastic pipe surfaces shall be lightly sanded before painting.

F. Wood Surfaces shall be dry. Sand to obtain a smooth surface. All encrustations shall be removed.

G. Exposed Pipe: Bituminous coated pipe shall not be used in exposed locations. Pipe which shall be exposed after project completion shall be primed in accordance with the requirements herein. Any bituminous coated pipe which is inadvertently installed in exposed locations shall be sandblasted clean before priming and painting. After installation all exterior, exposed flanged joints shall have the gap between adjoining flanges sealed with a single component
polysulfide sealant to prevent rust stains.

H. Primed or Previously Painted Surfaces and Nonferrous Surfaces: All coated surfaces shall be cleaned prior to application of successive coats. All nonferrous metals not to be coated shall be cleaned. This cleaning shall be done in accordance with SSPC-SP-1, Solvent Cleaning.

I. Shop-Finished Surfaces: All shop-coated surfaces shall be protected from damage and corrosion before and after installation by treating damaged areas immediately upon detection. Abraded or corroded spots on shop-coated surfaces shall be "Hand Cleaned" and then touched up with the same materials as the shop coat. All shop coated surfaces which are faded, discolored, or which require more than minor touch-up in the opinion of the Engineer shall receive new surface preparation before being repainted. Cut edges of galvanized sheets and exposed threads and cut ends of galvanized piping, electrical conduit, and metal pipe sleeves, that are not to be finished painted, shall be "Solvent Cleaned" and primed with zinc dust-zinc oxide metal primer.

J. Galvanized and Zinc-Copper Alloy Surfaces: These surfaces to be painted shall be "Solvent Cleaned" and treated as hereinafter specified. Such surfaces not to be painted shall be "Solvent Cleaned."

K. Aluminum embedded or in contact with concrete must be painted with one shop coat of zinc chromate followed by one heavy coat of aluminum pigmented asphalt paint.

3.02 WORKMANSHIP:

A. General:

1. Primer and paint used for a particular surface shall, in general, be as scheduled for that type of new surface. Confirm with the paint manufacturer that the paint proposed for a particular repaint condition will be compatible with existing painted surface. Sample repainted areas on the actual site will be required to insure this compatibility. Finished repainted areas shall be covered by the same guarantee specified for remainder of work.

2. At the request of the Engineer, samples of the finished work prepared in strict accordance with these Specifications shall be furnished and all painting shall be equal in quality to the approved samples. Finished areas shall be adequate for the purpose of determining the quality of workmanship. Experimentation with color tints shall be furnished to the satisfaction of the Engineer where standard chart colors are not satisfactory.
3. Protection of furniture and other movable objects, equipment, fittings and accessories shall be provided throughout the painting operations. Canopies of lighting fixtures shall be loosened and removed from contact with surface, covered and protected and reset upon completion. Remove all electric plates, surface hardware, etc., before painting, protect and replace when completed. Mask all machinery name plates and all machined parts not receiving a paint finish. Dripped or spattered paint shall be promptly removed. Lay drop cloths in all areas where painting is being done to adequately protect flooring and other work from all damage during the operation and until the finished job is accepted.

4. On metal surfaces apply each coat of paint at the rate specified by the manufacturer to achieve the minimum dry mil thickness required. If material has thickened or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. One gallon of paint as originally furnished by the manufacturer shall not cover a greater area when applied by spray gun than when applied unthinned by brush. Deficiencies in film thickness shall be corrected by the application of an additional coat(s). On masonry, application rates will vary according to surface texture, however, in no case shall the manufacturer's stated coverage rate be exceeded. On porous surfaces, it shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate or by applying additional coats of paint.

5. Paints shall be mixed in proper containers of adequate capacity. All paints shall be thoroughly stirred before use and shall be kept stirred while using. No unauthorized thinners or other materials shall be added to any paint.

6. Only skilled painters shall be used on the work and specialists shall be employed where required.

7. Mixing, thinning, pot life, application procedure, equipment, coverage, curing, re-coating, storage and number of coats shall be in accordance with coating manufacturer's instructions.

8. Avoid degradation and contamination of blasted surfaces, and avoid between coat contamination. Surfaces contaminated shall be cleaned before applying next coat. Method of cleaning contaminated surface shall be approved by the Engineer or owner’s representative.

9. Each application of material shall be worked into corners, crevices, joints, etc., and distributed evenly over flat surfaces. Spraying techniques that result in a uniform wet pattern shall be used and dry spraying should be avoided. Dry spray shall be removed prior to coating being applied.
10. All bolts, welds, sharp edges, and difficult access areas shall receive a primer brush coat or spray coat prior to primer spray application.

B. Field Priming:

1. Steel members, metal castings, mechanical and electrical equipment and other metals which are shop primed before delivery at the site will not require a prime coat on the job. All piping and other bare metals to be painted shall receive one coat of primer before exposure to the weather, and this prime coat shall be the first coat as specified in the painting schedule.

2. Equipment which is customarily shipped with a baked-on enamel finish or with a standard factory finish shall normally be field painted unless the prefinished equipment is specifically color selected and unless the finish has not been damaged in transit or during installation. Surfaces that have been shop painted and have been damaged, or where the shop coats or coats of paint have deteriorated, shall be properly cleaned and retouched before any successive painting is done on them in the field. All such field painting shall match as nearly as possible the original finish.

C. Field Painting:

1. All painting at the site shall be designated as Field Painting.

2. All paint shall be at room temperature before applying, and no painting shall be done when the temperature is below 50 degrees F, in dust-laden air, when rain or snow is falling, or until all traces of moisture have completely disappeared from the surface to be painted.

3. No paint shall be applied when the air or surface temperature, as measured in the shade, is below that which is recommended by the manufacturer. Paint shall not be applied to wet or damp surfaces, and shall not be applied in rain, snow, fog, mist, or when the surface temperature will be less than 5 F above the dew point. No paint shall be applied when it is expected that the surface temperature will drop below the manufacturer's recommendation within eight hours after the application of the paint. Dew or moisture condensation should be anticipated, and if such conditions are prevalent, painting shall be delayed until it is certain that the surfaces are dry; further, the days painting shall be completed well in advance of the probable time of day when moisture condensation will occur, in order to permit the film the required drying time as specified by the manufacturer prior to the formation of moisture. Care must be exercised that the coatings are not applied in too heavy a coat above that recommended by the manufacturer and that adequate drying time is permitted between coats to assure proper release of solvents.
4. Successive coats of paint shall be tinted so as to make each coat easily distinguishable from each other with the final undercoat tinted to the approximate shade of the finished coat.

5. Finish surfaces shall not show brush marks or other irregularities. Undercoats shall be thoroughly and uniformly sanded with No. 00 sandpaper or equal to remove defects and provide a smooth even surface. Top and bottom edges of doors shall be painted and all exterior trim shall be back-primed before installation.

6. Painting shall be continuous and shall be accomplished in an orderly manner so as to facilitate inspection. All exterior concrete and masonry paint shall be performed at one continuous manner structure by structure. Materials subject to weathering shall be prime coated as quickly as possible. Surfaces of exposed members that will be inaccessible after erection shall be cleaned and painted before erection.

7. All materials shall be brush painted unless spray painting is specifically approved by the Engineer. The Contractor shall be responsible for all damage caused by overspray or drifting.

8. All surfaces to be painted as well as the atmosphere in which painting is to be done shall be kept warm and dry by heating and ventilation, if necessary, until each coat of paint has hardened. Any defective paint shall be scraped off and repainted in accordance with the Engineer's directions.

9. Before final acceptance of the work, all damaged surfaces of paint shall be cleaned and repainted as directed by the Engineer.

10. Any pipe scheduled to be painted and having received a coating of a tar or asphalt-compound shall be painted with two coats of Rust-Oleum 9578 Coal Tar Epoxy, Induron Ruff Stuff 3300 or equal.

3.03 CLEANUP:

A. The premises shall at all times be kept free from accumulation of waste material and rubbish caused by employees or work. At the completion of the painting remove all tools, scaffolding, surplus materials, and all rubbish from and about the buildings and leave work "broom clean" unless more exactly specified.

B. Upon completion, remove all paint where it has been spilled, splashed or splattered on all surfaces, including floors, fixtures, equipment, furniture, etc., leaving the work ready for inspection.
C. All cloths and waste that might constitute a fire hazard shall be placed in closed metal containers or destroyed at the end of each day. Upon completion of the work, all staging, scaffolding, and containers shall be removed from the site and/or destroyed in an approved and legal manner. Paint spots, oil, or stains upon adjacent surfaces and floors shall be completely removed, and the entire job left clean and acceptable to the Engineer.

3.04 PAINT:

A. General Notes and Guidelines:

1. Pipe lines, equipment and all other items shall be assigned a color by the Owner and shall be treated an integral part of the Contract.
2. All moving parts, drive assemblies, and covers for moving parts which are potential hazards shall be Safety Orange.
3. All safety equipment shall be painted in accordance with Occupation Safety and Health Act (OSHA) standards.
4. All inline equipment and appurtenances not assigned another color shall be painted the same base color as the piping. The pipe system shall be painted with the pipe color up to but not including the flanges attached to pumps and mechanical equipment assigned another color. Tanks shall be painted the color of the piping system that they serve, unless the tank is fiberglass.
5. Building surface colors shall be painted as selected by the Owner.
   a. All color numbers and names herein refer to master color card.
   b. Pipe lines, equipment or other items which are not listed here shall be assigned a color by the Engineer and shall be treated an integral part of the Contract.
   c. All moving parts, drive assemblies, and covers for moving parts which are potential hazards shall be Safety Orange.
   d. All safety equipment shall be painted in accordance with Occupation Safety and Health Act (OSHA) standards.
6. All inline equipment and appurtenances not assigned another color shall be painted the same base color as the piping. The pipe system shall be painted with the pipe color up to but not including the flanges attached to pumps and mechanical equipment assigned another color. Tanks shall be painted the color of the piping system that they serve, unless the tank is fiberglass.
7. Building surface colors shall be painted as scheduled in the Finish Schedule or as selected by the Engineer.
8. Colors of the finish schedule shall be as follows: (colors are based on Glidden color charts)
B. DAMAGED COATINGS:

1. Damaged coatings, pinholes, and holidays shall have edges feathered and repaired in accordance with the recommendations of the manufacturer, as approved by the Engineer.

2. All finish coats, including touch up and damage-repair coats shall be applied in a manner which will present a uniform texture and color-match appearance.

C. UNSATISFACTORY APPLICATION:

1. If the item has an improper finish, color, or insufficient film thickness, the surface shall be cleaned and topcoated with the specified material to obtain the specified color and coverage. Specific surface preparation information to be secured from the coatings manufacturer and the Engineer.

2. All visible areas of chipped, peeled, or abraded paint shall be hand or power-sanded, feathering the edges. The areas shall then be primed and finish coated in accordance with the specifications.

3. Work shall be free of runs, bridges, shiners, laps, or other imperfections. Evidence of these conditions shall be cause for rejection.

4. Any defects in the coating system shall be repaired by the Contractor per written recommendations of the coating manufacturer.

D. GUARANTEE AND ANNIVERSARY INSPECTION:

1. All work shall be warranted for a period of one year from date of acceptance of the project.

2. The Owner will notify the Contractor at least 30 days prior to the anniversary date and shall establish a date for the inspection. Any defects in the coating system shall be repaired by the Contractor at no additional cost to the Owner. Should a failure occur to 25% of the painted surface, either interior or exterior, the entire surface shall be cleaned and painted in accordance with these specifications.

END OF SECTION 09900
SECTION 11010
PROCESS EQUIPMENT – GENERAL PROVISIONS

PART 1 - GENERAL

1.01 SCOPE:

Under this heading shall be included all labor, material, tools and skills necessary for the furnishing, installation, testing and adjustment of the various items of mechanical construction required under this contract. Each item shall be furnished complete, and installed as shown on the Plans and in accordance with these Specifications and the manufacturer's recommendations and instructions. In general, the mechanical construction included covers all process equipment.

The omission of any reference to parts necessary or incidental to a complete installation shall not be construed as releasing the Contractor from furnishing such parts.

1.02 CODES AND STANDARDS:

A. The Contractor shall obtain and pay for all licenses, permits, fees and charges. The Contractor shall be responsible for all charges for the use of property other than the site of the work for storage of materials or other purposes.

B. The Contractor shall comply with all ordinances, laws, regulations, and codes applicable to the work involved. This does not relieve the Contractor of work shown or specified which may be beyond the scope of such ordinances, laws, regulations and codes.

C. Regular inspections shall be requested by Contractor as required by governing codes or regulations.

D. The Occupational Safety and Health Act of 1970, Public Law 91-596, shall apply to the mechanical work of Division 15.

1.03 SHOP DRAWINGS:

A. Shop drawings for all items of mechanical equipment specified hereunder and related accessory items shall be submitted. Shop drawings shall be specific to this particular piece of equipment and respective process system.

B. Shop drawings shall include layout drawings of all piping 3 inches in diameter and larger.
C. The Contractor shall submit for review by the Engineer a complete schedule and data on materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive material, catalog cuts, diagrams, performance curves, and charts published by the manufacturer to show conformance to specification and drawing requirements; model numbers alone will not be acceptable.

D. Each individual submittal item for materials and equipment shall be marked to show specification section and paragraph number which pertains to the item. Failure to mark submittals in accordance with the above format shall be considered due cause for rejection of shop drawings.

E. The purpose of shop drawing submittals is to demonstrate to the Engineer that the Contractor understands the design concept. Review of the drawings, schedules, or cuts by the Engineer shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless he has, in writing, called the Engineer's attention to such deviation at the time of submission. All shop drawings must be completely checked by the Contractor prior to submission for approval.

F. The Contractor shall submit the following information printed on each and every sheet of Shop Drawings and on the cover page of each and every specification.

1. Name of the Contractor.

2. Name and location of the Project.

3. Name of the Engineer.

4. Name of the Consultant (if applicable).

5. Drawing Number.

6. Date of Drawing.

7. The following Statement:
   a. "The (Contractor's name) is solely responsible for the accuracy and completeness of these Shop Drawings. To the best of our knowledge, they conform to the intent of the Plans and Specifications, and we approve them for use in the field for construction purposes."

8. Signed: (Officer, Partner, Etc.)
   (Date of Approval)

9. Drawings not so stamped will be returned to Contractor without action.
10. Shop drawings shall be stamped by the Engineer with the following classifications:
   
a. No Exceptions Taken.

   No corrections, no marks. Contractor shall submit copies for distribution.

b. Make Corrections Noted.

   A few minor corrections. Items may be ordered as marked up without further resubmission. Submit copies for distribution.

c. Amend and Resubmit.

   Minor corrections. Items may be ordered at the Contractor's option. Contractor shall resubmit drawings with corrections noted.

d. Rejected and Resubmit.

   Major corrections or not in accordance with the Contract.

G. Prior to submitting approval data for equipment requiring electrical service, the Contractor shall verify that electrical characteristics of equipment submittals comply with electrical service provided for the specified items of equipment.

H. The Contractor shall coordinate the electrical service requirements, i.e., motor horsepower and full load amps, and electrical service characteristics (voltage and phase) for each item of equipment requiring electrical connections with the electrical drawings and specifications. The Contractor shall furnish to the Engineer a complete, typewritten list of electrical requirements for each item of equipment to be installed.

1.04 MOTORS:

A. Motors shall conform with applicable NEMA, IEEE and USASI Standards and shall be as manufactured by Louis Allis, Allis Chalmers, Electric Machinery, Fairbanks-Morse, General Electric, or approved equal. Motors using non-standard frames or otherwise specified characteristics will be permitted only by special permission of the Engineer, the intent being to confine each such usage to cases of absolute necessity.

B. Motors rating shall be based on current NEMA Design Standards for continuous operation. Horsepower, torque and speed characteristics shall be suitable for the full normal range of operating conditions of the driven equipment without
exceeding the nameplate FLC and/or temperature rise ratings. Wherever specified, this fact shall be prominently noted on the shop drawings submitted, or otherwise brought to the attention of the Engineer.

C. Process and major mechanical equipment drive motors shall be 3 phase, 60 Hz, squirrel-cage induction type NEMA Design B, 460 voltage in all sizes where this rating is standard. Large motors and special motors where dual voltage construction is not available shall be furnished in ratings consistent with the nominal system voltage. Where process drives of fractional horsepower are required, standard frame 56 units shall be supplied. Such drive requiring limited power input shall employ overload heaters undersized accordingly.

D. Motor frames shall be totally enclosed and fan-cooled unless otherwise specified for special equipment. All motors furnished in NEMA 56 frame or larger shall have permanently lubricated anti-friction bearings with provision for re-lubrication; however, 7.5 hp and lower may be provided with double-sealed bearings without provisions for re-lubrication.

E. Frame shall be NEMA T-Frame, cast iron with cast iron brackets. Motors shall be suitable for severe duty/chemical duty service with chemical resistant paint on inside and outside surfaces. Service factor shall be 1.15; power factor for motors 20 hp and larger shall be .85 min; power factor for motors smaller than 20 hp shall be suitable for correction to .95. Motors 3 hp and larger shall be premium efficiency, with efficiencies complying with NEMA MG1, 1993, Section 12, Table 10. Motors of 75 hp and larger shall have provisions for sensing required SCADA I/O, e.g., vibration and bearing temperature. Signals shall be discrete. Motors shall be equipped with 120v space heaters where specified on the drawings or in the specifications.

F. General purpose single phase motors ½ horsepower and smaller, shall be 115 volt capacitor start type designed for continuous duty. Light duty motors of the domestic appliance variety will not be acceptable in this work.

G. All motors shall be supplied with adequately sized connection boxes of a type and location suitable for the installation.

H. The division furnishing motors, or equipment containing or including motors, shall be responsible for delivery, handling and setting regardless of local agreements as to actual work jurisdiction. Further, this responsibility shall include checking of lubrication, drive alignment and condition, indication of proper rotation, and any or all other matters relating to operative readiness. When all checks are satisfactorily accomplished, the readiness of the unit for operations shall be indicated by a conspicuous and legible tag installed by the responsible individual.
I. As part of the initial operational test, the responsible division shall arrange for checking and recording of load current and verification of rating of overload heaters. No unattended operation of the equipment shall be permitted until completion of these procedures.

1.05 GEAR REDUCERS:

A. Gear reducers, where required, shall be of the horizontal straightline concentric type with heat treated alloy steel precision cut helical gearing. All gearing shall comply with the requirement of AGMA with a 1.5 service factor for continuous operation. AGMA rating plates shall be attached to the housing.

B. All shafts shall be of high carbon steel forgings turned and ground to size. Shafts shall be mounted on anti-friction bearings. All gearing shall be lubricated by revolving through lubricating oil reservoir. Ample volume shall be provided for the oil to act both as a lubricant and a coolant. Provide oil seals at all shafts. Housings shall be dust and moisture tight and shall have an easy means of filling, draining and checking the oil level.

C. Drive motors shall be separate from the gear reducer. Output shaft of the motor shall be connected to the input of the gear reducer with a shear pin or torque overload type coupling to protect against overload. The shear pin or torque overload type coupling between the motor and reducer may be deleted on units that are specifically required to have a shear pin hub on the gear reducer output sprocket or on the drive sprocket of the equipment.

1.06 ENCLOSURES:

All electrical control devices or similar items appurtenant to the major equipment shall be furnished with dust and moisture tight enclosures except in such locations or for such pieces of equipment where explosion-proof enclosures are called for. All devices requiring explosion-proof enclosures shall be as approved by the National Electrical Code for Class 1, Division 1, Group D.

1.07 GUARDS:

All couplings and rotating shafts shall be covered with a substantial, removable sheet metal or expanded metal guard or screen.

1.08 VIBRATION LIMITATIONS:

All rotating equipment shall be furnished and installed such that the finished installation operates within certain limits of acceptable vibration. Limitations of the maximum peak to peak amplitude for lateral and axial vibration at various operating speeds specified in Section 01900, which is attached herewith. Tests for compliance with vibration limitations shall be performed as specified for specific pumping equipment.
1.09 VERIFICATION OF CONTRACT PLANS:

A. The plans indicate certain required pipe sizes and the general arrangement for major piping and equipment. Layout and arrangement for certain other piping systems shall be provided in conformance to the equipment items furnished and shall be verified in the field by the Contractor. Valves and fittings furnished shall be of such dimensions to allow for the installation of piping substantially as shown on the Plans. In the event it should become necessary to change the location of any of the work due to interference with other work, the Contractor shall consult with the Engineer before making any changes. Any such changes shall be made without added cost to the Owner. Under no circumstances shall the pipe sizes indicated on the Plans be changed without first having notified the Engineer.

B. The Contractor shall determine and be responsible for the proper locations and character of all inserts for hangers, chases, sleeves and other openings in the construction required for all mechanical piping work.

C. The final location of inserts, hangers, etc., required for the mechanical piping installation shall be coordinated with facilities required for other installations to prevent interference.

D. The final length and location of required pipe connections to all process equipment shall be coordinated to meet the requirements and recommendations of the equipment manufacturer.

E. The Contractor shall install no work that directly connects to equipment until such time as complete shop drawings of such equipment have been received by the Engineer.

F. The drawings are essentially to scale as noted but the Contractor shall refer to other drawings for exact location of partitions, walls, doors, equipment, etc.

G. The Contractor, before roughing in any facilities or installation of any equipment, shall consult all drawings, general, mechanical, electrical, etc., and shall inform himself of materials, finishes, location of ceilings, structural members, pipes, ducts, lighting fixtures, conduits, etc., which may affect the installation.

H. Discrepancies discovered before or after work has started, shall be brought to the attention of the Engineer immediately and the Engineer reserves the right to require minor changes in the work of any Contractor to eliminate such discrepancies.

I. The Plans and Specifications are complementary and what is called for in either one shall be binding as if called for in both.
1.10 EQUIPMENT INSTALLATION:

A. Equipment installation shall conform with the layout requirements shown on the Plans and shall also be in accordance with the manufacturer’s recommendations and instructions.

B. The Contractor shall be responsible for determining and/or verifying all dimensions of the related structures, equipment and piping required for the proper fabrication and installation of all new equipment.

C. A time schedule for each phase of work shall be submitted for approval as required under the Special Conditions of these Specifications.

D. Concrete bases and curbs and isolated foundations for all equipment will be provided under the General Divisions of this Contract. Anchor bolts are to be furnished and set under this Contract.

E. All motor starters and electrical wiring shall be furnished under the Electrical Division unless specified hereinafter.

F. All equipment shall be placed on the foundations, leveled, shimmed, bolted down and grouted in with a non-shrinking grout.

G. The Contractor shall provide any necessary shoring for protection of existing structures during placing of equipment. All equipment shall be properly protected from damage and weather both prior to installation and also after installation and during subsequent construction operations.

H. Prior to start-up, all equipment shall be properly lubricated and all gear reducers and hydraulic systems shall be properly filled by the Contractor. All lubricants and hydraulic fluids shall be furnished by Contractor.

1.11 EQUIPMENT REQUIRING MODIFICATIONS:

The Contract Plans show piping, appurtenances and equipment required for the Project. If a contract is entered into which includes items of equipment requiring any modifications or deviations from the Contract Plans, the Contractor shall prepare and submit to the Engineer detailed drawings showing all modifications in structures, piping, electrical and mechanical work to adapt Contract Plans to the alternate equipment or facilities. These supplemental drawings shall comply with the level of quality, scales and degree of detail used on the Contract Plans. The Engineer will review such drawings prepared by the Contractor and indicate thereon, or in a letter, any changes necessary to comply with the Project requirements. The Contractor shall revise any unapproved drawings and resubmit them to the Engineer for further consideration.
1.12 FACTORY TESTS:

Factory tests shall be performed as specified under the detailed specification for each item of equipment.

1.13 ANCHOR BOLTS:

Anchor bolts, nuts and washers shall be Type 316 Stainless Steel and as shown on the Plans. Anchor bolts for equipment shall be set in standard weight mild steel pipe sleeves having an internal diameter twice that of the anchor bolt. Anchor bolts shall be furnished by the manufacturer and shall be of adequate size and number to securely anchor each item of equipment. Anchor bolts shall be set by template and shall be protected from misalignment.

1.14 VERIFICATION OF EXISTING CONDITIONS:

A. The Contractor shall be responsible for taking and/or verifying any dimensions of the existing structures and piping or equipment required for the proper fabrication and installation of all piping and equipment.

B. It is recommended that all bidders familiarize themselves with the site and with the conditions existing.

1.15 CLEAN-UP:

A. Contractor shall periodically clear away all debris, surplus materials, etc., resulting from his work or operations, leaving the job and the equipment furnished under any or all Contracts in a clean condition.

B. The Contractor shall thoroughly clean all fixtures, removing all plaster, paint, stickers, rust stains, and other foreign matter or discolorations, leaving every part in an acceptable condition and ready for use.

C. The Contractor shall thoroughly clean all strainers and pipe lines prior to testing, leaving each line in first class condition.

1.16 NAMEPLATES AND IDENTIFICATION TAGS:

Each piece of equipment furnished as a part of the respective mechanical piping system, shall have a standard nameplate securely affixed thereto in a conspicuous place, showing the serial number and the name of the manufacturer. In addition, the nameplate shall show the rated capacity of the unit at specified conditions. Motor nameplates shall show the horsepower, speed and electric current characteristics. The nameplates of a distributing agent will not be acceptable.
1.17 PAINTING:

All equipment, motors, drive assemblies and bases shall be furnished with a factory paint finish which is compatible with the paint specified under the Painting Section of this Specification. Pipe materials shall be factory primed as specified for the particular pipe system hereinafter. All field painting, touch-up painting, and stenciling is specified under Section 09900 of this Specification titled "Painting."

1.18 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Operating and maintenance instructions, printed and bound in hard cover three ring loose leaf notebooks, shall be provided for each item of equipment; six separate copies shall be provided. Each notebook shall be provided with an identifying label under a clear plastic cover shield on the front cover which shall identify the Project, Engineer, Contractor and Date.

B. Operation and maintenance instructions are to be submitted to the Engineer with 4 weeks of shop drawing approval to facilitate compilation of the Plant Operation and Maintenance manual required to be submitted to DHEC when construction is complete.

B. Prior to the final inspection and at a time designated by the Engineer, the services of a competent representative shall be provided by the Contractor to instruct the owner in the operation and maintenance of all equipment.

1.19 FACTORY AND FIELD TESTING:

All mechanical equipment and piping systems shall be subjected to factory and field testing in accordance with requirements specified for the particular equipment, and also in accordance with requirements of the Special Conditions for overall testing.

1.20 INSTRUCTION MANUALS:

Instruction Manuals and Parts Lists shall be submitted as specified in the General and/or Special Conditions of this Specification. Manuals shall be prepared specifically for the particular piping and equipment system furnished, and shall consider the specific operations of this process system.

1.21 PRESSURE TESTING:

A. All mechanical piping systems shall be pressure tested after installation. All liquid systems shall be tested hydrostatically or pneumatically at the Contractor's option. If air pressure is used for testing the Contractor shall be responsible for all safety precautions necessary to prevent possibility of personal injury in the event of blow-off or material failure during test.
B. All systems shall be tested at the pressure level specified hereinafter, or if not specified, at a pressure of at least 150 percent (150%) of maximum operating pressure. After bringing the system to the required pressure it shall be left for at least one hour and shall show no loss in pressure due to leakage.

C. If leakage is detected the cause shall be determined and corrected, and the test shall be conducted again at the expense of the Contractor.

1.22 ADJUSTMENT AND START-UP:

A. After completion of installation of all mechanical work, the equipment and installation shall be inspected and approved by a representative of the manufacturer as being in compliance with the manufacturer's recommendations and requirements. After such inspection the equipment shall be given any required adjustment and when complete the various items of equipment shall be placed into operation under the supervision of the manufacturer's representative.

B. All equipment shall be placed into operation in accordance with a schedule properly coordinated with the Engineer.

1.23 INSTRUCTION OF OPERATING PERSONNEL:

Instruction of operating personnel shall be provided for all mechanical systems and equipment in accordance with requirements of the Special Conditions of the Contract.

1.24 GUARANTEE:

All equipment shall be guaranteed as specified under the General and Special Conditions. Guarantee of all equipment shall start and coincide with the Contractor's guarantee obligations.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION 11010
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Foundations including wall footings, spread footings, and footings monolithic with the slab.
2. Foundation walls.
3. Tank walls and walkways.
4. Slabs-on-grade.
5. Concrete toppings.
6. Equipment pads and bases.

B. Related Sections include the following:
   1. Division 2 Section "Earthwork."

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, subject to compliance with requirements.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

   1. Indicate amounts of mixing water to be withheld for later addition at the Project site.
C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate the proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

E. Welding certificates.

F. Qualification Data: For Installer.

G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating the absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

H. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
10. Adhesives.
11. Vapor retarders.
12. Semirigid joint filler.

I. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

J. Field quality-control test and inspection reports.

K. Minutes of preinstallation conference.
1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products, and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician, and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
3. ACI 318, “Building Code Requirements for Reinforced Concrete.”

G. Supervision: All reinforced concrete construction shall be performed under the personal supervision of the contractor’s superintendent. The superintendent shall keep a record of all concrete placed on the job. The record shall show in detail the area placed, the time and date of the placement, and weather conditions that existed at the time of placement. Upon completion of the work, this record shall be turned over to the Engineer.
H. Concrete Testing Service: The contractor shall engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring the quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete subcontractor.

2. Review testing and inspecting agency procedures for field quality control, concrete finishes, and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction, and isolation joints, and joint-filler strips, semirigid joint fillers, forms, and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under protective cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in the largest practicable sizes to minimize the number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
   a. High-density overlay, Class 1, or better.
   b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
   c. Structural 1, B-B or better; mill oiled and edge sealed.
   d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for a tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support the weight of plastic concrete and other superimposed loads.


G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate a form-release agent with rust inhibitor for steel form-facing materials.

I. Form Ties: Factory-fabricated, removable, or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist the lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in the concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.

D. Plain-Steel Wire: ASTM A 82.

E. Deformed-Steel Wire: ASTM A 496.

F. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.


2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated, or another dielectric-polymer-coated wire bar supports.
3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
4. For foundations, support reinforcing a maximum of 4'-0" on center.

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II except foundations (wall footings, spread footings, etc.) shall be Type II. Supplement with the following:
a. Fly Ash: ASTM C 618, Class F.

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.


2.6 ADMIXTURES


B. Chemical Admixtures: Provide admixtures certified by the manufacturer to be compatible with other admixtures, and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
   7. Carbon Concrete Additive Admixture: ASTM C 494/C 494M, Type F.
      a. Available Product: Concrete Carbon Nanotube additive.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
   1. Available Products:
      a. Boral Material Technologies, Inc.; Boral BCN.
      b. Euclid Chemical Company (The); Eucon CIA.
      c. Grace Construction Products, W. R. Grace & Co.; DCI.
      d. Master Builders, Inc.; Rheocrete CNI.
      e. Sika Corporation; Sika CNI.

D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
1. Available Products:
   a. Axim Concrete Technologies; Catexol 1000CI.
   d. Grace Construction Products, W. R. Grace & Co.; DCI-S.
   e. Master Builders, Inc.; Rheocrete 222+.
   f. Sika Corporation; FerroGard-901.

2.7 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Available Products:
   a. Fortifiber Corporation; Moistop Ultra A.
   b. Raven Industries Inc.; Vapor Block 10.
   c. Reef Industries, Inc.; Griffolyn Type-65G 105.

B. Plastic Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Available Products:
   a. Fortifiber Corporation; Moistop Ultra.
   b. Raven Industries Inc.; Vapor Block 10.
   c. Stego Industries, LLC; Stego Wrap, 15 mils.

C. Plastic Vapor Retarder: ASTM E 1745, Class C, or polyethylene sheet, ASTM D 4397, not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

1. Available Products:
   a. Fortifiber Corporation; Moistop Plus.
   d. Stego Industries, LLC; Stego Wrap, 10 mils.

D. Bituminous Vapor Retarder: 110-mil- thick, semiflexible, 7-ply sheet membrane consisting of reinforced core and carrier sheet with fortified asphalt layers, protective weather coating, and removable plastic release liner. Furnish manufacturer's accessories, including bonding asphalt, pointing mastics, and self-adhering joint tape.

2. Water-Vapor Permeance: 0.00 grains/h x sq. ft. x inches Hg; ASTM E 154.
E. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

F. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.8 CURING MATERIALS


1. Available Products:
   a. Axim Concrete Technologies; Cimfilm.
   b. Burke by Edoco; BurkeFilm.
   c. ChemMasters; Spray-Film.
   d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
   e. Dayton Superior Corporation; Sure Film.
   f. Euclid Chemical Company (The); Eucobar.
   g. Kaufman Products, Inc.; Vapor Aid.
   h. Lambert Corporation; Lambo Skin.
   i. L&M Construction Chemicals, Inc.; E-Con.
   j. MBT Protection and Repair, Div. of ChemRex; Confilm.
   l. Metalcrete Industries; Waterhold.
   m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
   n. Sika Corporation, Inc.; SikaFilm.
   o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
   p. Unitex; Pro-Film.
   q. US Mix Products Company; US Spec Monofilm ER.
   r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film, or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Available Products:
   a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
   b. Burke by Edoco; Aqua Resin Cure.
   c. ChemMasters; Safe-Cure Clear.
   d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.
   e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
   f. Euclid Chemical Company (The); Kurez DR VOX.
   g. Kaufman Products, Inc.; Thinfilm 420.
   h. Lambert Corporation; Aqua Kure-Clear.
   i. L&M Construction Chemicals, Inc.; L&M Cure R.
   k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
   l. Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.
   m. Tamms Industries, Inc.; Hornecure WB 30.
   n. Unitex; Hydro Cure 309.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with the bonding of floor covering.

1. Available Products:
   a. Anti-Hydro International, Inc.; AH Clear Cure WB.
   b. Burke by Edoco; Spartan Cote WB II.
   c. ChemMasters; Safe-Cure & Seal 20.
   d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Cure and Seal WB.
   e. Dayton Superior Corporation; Safe Cure and Seal (J-18).
   f. Euclid Chemical Company (The); Aqua Cure VOX.
   g. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
   h. Lambert Corporation; Glazecote Sealer-20.
   i. L&M Construction Chemicals, Inc.; Dress & Seal WB.
   k. Metalcrete Industries; Metcure.
   l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 150E.
   m. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
   n. Tamms Industries, Inc.; Clearseal WB 150.
   o. Unitex; Hydro Seal.
   p. US Mix Products Company; US Spec Hydrasheen 15 percent
   q. Vexcon Chemicals, Inc.; Starseal 309.

G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with the bonding of floor covering.
1. Available Products:

   a. Burke by Edoco; Spartan Cote WB II 20 Percent.
   b. ChemMasters; Safe-Cure Clear.
   c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
   d. Dayton Superior Corporation; Safe Cure and Seal (J-19).
   e. Euclid Chemical Company (The); Diamond Clear VOX.
   g. Lambert Corporation; Glazecote Sealer-20.
   h. L&M Construction Chemicals, Inc.; Dress & Seal WB.
   i. MBT Protection and Repair, Div. of ChemRex; MasterKure-N-Seal VOC.
   k. Metalcrete Industries; Metecure 0800.
   l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 200E.
   m. Sonneborn, Div. of ChemRex; Kure-N-Seal.
   n. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
   o. Tamms Industries, Inc.; Clearseal WB STD.
   p. Unitex; Hydro Seal 18.
   q. US Mix Products Company; US Spec Radiance UV-25
   r. Vexcon Chemicals, Inc.; Starseal 0800.

H. Clear, Solvent-Borne, Membrane-Forming Curing, and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Available Products:

   a. Burke by Edoco; Cureseal 1315.
   b. ChemMasters; Spray-Cure & Seal Plus.
   c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315.
   d. Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV).
   e. Euclid Chemical Company (The); Super Diamond Clear.
   g. Lambert Corporation; UV Super Seal.
   h. L&M Construction Chemicals, Inc.; Lumiseal Plus.
   j. Metalcrete Industries; Seal N Kure 0.
   k. Sonneborn, Div. of ChemRex; Kure-N-Seal 5.
   l. Tamms Industries, Inc.; LusterSeal 300.
   m. Unitex; Solvent Seal 1315.
   n. US Mix Products Company; US Spec CS-25
   o. Vexcon Chemicals, Inc.; Certi-Vex AC 1315

I. Clear, Waterborne, Membrane-Forming Curing, and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Available Products:
2.9 RELATED MATERIALS


B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240. 

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion, or styrene-butadiene. 

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types I for bonding hardened or freshly mixed concrete to hardened concrete. 

E. Reglets: Fabricate reglets of not less than 0.0217-inches thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris. 

F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inches thick, with bent tab anchors. Temporarily fill or cover the face opening of slots to prevent intrusion of concrete or debris. 

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlay: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not more than 35 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 20 percent.
2. Combined Fly Ash and Pozzolan: 20 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to the manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, and concrete with the water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
5. Use carbon concrete additive (Carbon Nanotube) at 1 gallon per cubic yard.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with the approved mockup.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and Slab-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: psi 4,500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at the point of delivery.

B. Liquid Containment Structures: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 4 inch slump concrete.
4. Air Content: 6 percent, plus or minus 1.5 percent at the point of delivery.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When the air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when the air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2. Provide batch ticket for each batch discharged and used in the Work indicating Project identification name and number, date, mix type, time, quantity, and amount of water.

3. No water shall be added at the job site unless approved by the Engineer in writing.
B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in an appropriate drum-type batch machine mixer.

1. For a mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in the mixer, before any part of the batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record the approximate location of the final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until the structure can support such loads.

B. Provide Class A for concrete surfaces exposed to view and inside of tank walls. Provide Class C for other concrete surfaces.

C. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

D. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

   2. Class B, 1/4 inches Class C, 1/2 inch Class D, 1 inch for rough-formed finished surfaces.

E. Construct forms tight enough to prevent loss of concrete mortar.

F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
H. Provide temporary openings for cleanouts and inspection ports where the interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

M. Coat contact surfaces of forms with a form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.4 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

B. Bituminous Vapor Retarders: Place, protect, and repair vapor retarders according to manufacturer's written instructions.

C. Granular Course: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

1. Place and compact a 1/2-inch-thick layer of fine-graded granular material over granular fill.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer. Wet the joint prior to subsequent pour. Remove any standing water prior to pour. Subsequent pours shall be a minimum of 48 hours apart. See Section S3.7 for Concrete Placement at Liquid Retaining Structures.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.
3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.

C. Placement Sequence – To minimize the effect of shrinkage in producing cracks, all liquid retaining structures shall be constructed using a placement sequence. For these structures, concrete shall be placed as follows:

1. Bottom slab. Each bottom slab shall be divided into sections by the construction joints indicated on the drawings and, when not indicated on the drawings, into approximately square sections not greater than 50 feet in their longest dimension. Bottom slabs with radial and circumferential reinforcement patterns may be divided into pie shaped segments with the longest dimension not greater than 50 feet. A section near the center shall be placed first. Sections shall be placed alternately, first on one side and then on the other side of previously placed sections. Placement shall be scheduled so that two adjacent sides of each section are free, except at closures.

2. Walls. Walls shall be divided into sections by the construction joints indicated on the drawings and, when not indicated on the drawings, into sections not greater than 30 feet in length. A section near the center of the wall shall be placed first. Sections shall be placed alternately, first on one side, then on the other side of the previously placed section. Placement shall be scheduled so that one end of the each section is free, except at corner closures.

3. Top Slabs. Each top slab shall be placed in the manner subscribed for the bottom slab.

No two abutting sections shall be placed within a period of 48 hours, unless otherwise authorized by the Engineer.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete
embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to view (inside of tanks below water level shall have a Smooth-Formed Finish).

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and
patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces to receive a rubbed finish, inside of tanks below water level, concrete to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete to all concrete surfaces exposed to view including inside of tank walls above the water level:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces except at walkways. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction. After placing slabs, finish surface to tolerances of F(F) 15 (floor flatness and F(L) 13 (floor levelness) measured according to ASTM E1155.

1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes or for concrete to receive a grouted overlay for slope. Slope surfaces uniformly to drains where required.
C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish, bottom of tanks (except clarifiers or other tanks to receive grout), and concrete to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view, grouted bottom of clarifiers, or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

   a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4 inch

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, walkways at top of tanks and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing. Curing is the preferred method of curing moisture protection.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue moist curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Provide moisture curing for all liquid retaining structures. Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply curing compound on exposed interior slabs and on exterior slabs, walks and curbs. Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and
mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contractor shall engage a qualified testing agency to perform tests and to submit reports.

B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample, or three sets of two standard cylinders, for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

7. Compression Test Specimens: ASTM C 31/C 31M.
a. Cast and laboratory cure three sets of two standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

11. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device (Windsor Probe not Swiss Hammer) may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.

14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

C. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE:

This Section specifies the basic administrative and testing requirements for piping. Specific piping materials, systems and related installation and testing requirements are specified in other Sections of Division 2 and 15.

1.02 RELATED WORK:

A. Piping materials and systems are included in other Sections of Division 2 and 15.

B. Valves are included in Section 15996.

C. Pipe Testing - General Requirements are included in Section 15988.

1.03 SUBMITTALS:

A. General submittals for piping and piping systems are listed below. Submittals shall be in accordance with Sections 11010 and 01500. It is not intended that all submittals listed below be provided for all piping materials and systems. Refer to individual System or Piping Sections for specific submittals.

B. Shop Drawings and Product Data

1. Piping layouts in full detail.
2. Location of pipe hangers and supports.
3. Location and type of backup block or device to prevent joint separation.
4. Large scale details of wall penetrations and fabricated fittings.
5. Schedules of all pipe, fittings, special castings, couplings, expansion joints and other appurtenances.
6. Catalog cuts of joints, couplings, harnesses, expansion joints, gaskets, fasteners and other accessories.
7. Brochures and technical data on coatings and linings and proposed method for application and repair.

C. Samples

D. Design Data
E. Test Reports

1. Six copies of certified shop tests showing compliance with appropriate standard.
2. Six copies of all field test reports, signed by Contractor and Engineer.

F. Certificates

1. Copies of certification for all welders performing work in accordance with ANSI B31.1.

G. Manufacturers Installation (or application) instructions.

H. Statement of Qualifications

I. Manufacturers Field Report

J. Project Record Document

K. Operation and Maintenance Data in accordance with Section 01600.

L. Warranties

1.04 REFERENCE STANDARDS:

A. American Society for Testing and Materials (ASTM)

1. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

B. American National Standards Institute (ANSI)

1. ANSI B16.5 - Pipe Flanges and Flanged Fittings
2. ANSI B31.1 - Power Piping

C. American Welding Society (AWS)

1. AWS B3.0 - Welding Procedure and Performance Qualifications

D. American Water Works Association (AWWA)


E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.
1.05 QUALITY ASSURANCE:

A. All materials shall be new and unused.

B. Install piping to meet requirements of local codes.

C. Provide manufacturer's certification that materials meet or exceed minimum requirements as specified. Reference to standards such as ASTM and ANSI shall apply to those versions in effect at the time of bid opening.

D. Coordinate dimensions and drilling of flanges with flanges for valves, pumps and other equipment to be installed in piping systems. Bolt holes in flanges to straddle vertical centerline.

E. Reject materials contaminated with gasoline, lubricating oil, liquid or gaseous fuel, aromatic compounds, paint solvent, paint thinner and acid solder.

F. Pipe-joint compound, for pipe carrying flammable or toxic gas, must bear approval of Underwriters' Laboratories or Factory Mutual Engineering Division.

G. Unless otherwise specified, pressures referred to in all Piping Sections are expressed in pounds per square inch gage above atmospheric pressure, PSIG, and all temperatures are expressed in degrees Fahrenheit.

1.06 DELIVERY, STORAGE AND HANDLING:

During loading, transportation and unloading, take care to prevent damage to pipes and coating. Carefully load and unload each pipe under control at all times. Place skids or blocks under each pipe in the shop and securely wedge pipe during transportation to ensure no injury to pipe and lining.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Specific piping materials and appurtenances are specified in the respective Piping or System Sections.

B. General installation materials shall be as specified below.

1. Unions shall be brass or bronze unions for joining nonferrous pipe; malleable brass or bronze-seated iron or steel unions for joining ferrous pipe; PVC unions for joining PVC pipe; CPVC unions for joining CPVC pipe.
2. **Flanged Joints.** Bolt and nuts, Grade B, ASTM A307, hot dip galvanized, bolt number and size same as flange standard; studs - same quality as machine bolts; 1/16-in thick rubber gaskets with cloth insertions; rust-resistant coatings.

3. **Temporary Plugs** shall be standard plugs or caps which are suitable for permanent service.

4. **Flexible Connections** shall be flanged spool type, 180 degree F maximum service, single filled arch with synthetic rubber tube and cover, steel-ring reinforced synthetic fiber carcass, with flanges drilled to 150-lb ANSI B16.5 Standard. Stainless steel retaining rings, control rods and compression sleeves shall be provided where shown and as required for the working pressure of the system in which the joint is installed. All flexible joints shall be rated for the working pressure of the system in which they are installed. Flexible connections shall be Red Valve or equal.

### 2.02 INSULATION:

A. **Piping,** valves and appurtenances shall be insulated as shown on the Drawings and specified herein. In general, all liquid lines subject to freezing shall be insulated. Gravity drain lines that are normally empty shall not be insulated. In addition, all lines to be insulated shall be heat traced with self-regulating electrical heat as specified in Division 16.

B. **Insulation products** shall be manufactured by Owens-Corning, Johns-Manville or approved equal. The average thermal conductivity rating shall not exceed 0.25 Btu/hr-sq. ft.-°F per inch at a mean temperature of 75°F. Insulation shall have a flame spread rating not exceeding 25 and a smoke developed rating not higher than 50.

C. All insulation exposed to the weather shall be furnished with an outer aluminum waterproof jacket and neatly secured in place with aluminum bands.

D. Insulation shall be furnished for all piping, valves, and appurtenances on the line to be insulated. Insulation for valves and fittings shall be the same thickness as the connected pipe. No insulation shall interfere with the travel or working part of any valve stem or appurtenance.

E. All outdoor chemical carrying piping, valves and appurtenances shall be freeze protected with heavy duty fiberglass insulation, Owens-Corning ASJ/SSL-II or approved equal. Insulation thicknesses shall be 1-1/2 inches for pipe sizes 1-½ inches and greater and 3/4-inch for pipes less than 1-1/2 inches.
PART 3 - EXECUTION

3.01 GENERAL:

A. All dirt, scale, weld splatter, water and other foreign matter shall be removed from the inside and outside of all pipe and sub-assemblies prior to installing.

B. All pipe joints and connections to equipment shall be made in such a manner as to produce a minimum of strain at the joint.

C. Install piping in a neat manner with lines straight and parallel or at right angles to walls or column lines and with risers plumb. Run piping so as to avoid passing through ductwork or directly under electric light outlets and/or interference with other lines. All work shall be accomplished using recognized methods and procedures of pipe fabrication and in accordance with the latest revision of applicable ANSI Standards, ASME Codes and Pipe Fabrication Institute Standards.

1. Use full length of pipe except where cut lengths are necessary. Do not spring or deform piping to make up joints.

2. Pipe shall be cut square, not upset, undersize or out of round. Ends shall be carefully reamed and cleaned before being installed. Bending of pipe is not permitted. Use fittings for all changes in direction.

3. Do not use bushings except where specifically approved by the Engineer. Reducers shall be eccentric to provide for drainage from all liquid-bearing lines and facilitate air removal from water lines.

4. Verify the locations and elevations of any existing piping and manholes before proceeding with work on any system. Any discrepancies between the information shown on the Drawings and the actual conditions found in the field shall be reported at once to the Engineer. No claim for extra payment will be considered if the above provision has not been complied with.

5. Where lines of lower service rating tie into services or equipment of higher service rating the isolation valve between the two shall conform to the higher rating.

6. Mitering of pipe to form elbow is not permitted.

7. All piping interiors shall be thoroughly cleaned after installation and kept clean by approved temporary closures on all openings until the system is put in service. Closures should be suitable to withstand the hydrostatic test.

8. End caps on pre-cleaned pipe shall not be removed until immediately before assembly. All open ends shall be capped immediately after completion of installation.
D. Test Connections

1. Provide 1/2-in female N.P.T. test connection equipped with 1/2-in brass plug on all pump suction and discharge lines. Where indicated on the Drawings, test connections should be equipped with bar stock valve and gage.

E. Unions

1. Unions screwed or flanged shall be provided where indicated and in the following locations even if not indicated.
   a. In long runs of piping to permit convenient disassembly for alterations or repairs.
   b. In by-passes around equipment.
   c. In connections to tanks, pumps and other equipment between the shut-off valve and the equipment.
   d. In connections on both sides of traps, controls and automatic control valves.

F. Vents and Drains

1. Provide vents and drains in the following places:
   a. Water Lines - Vents at high points and drains at low points.
   b. Air Lines - Drains at low points.

3.02 WELDING:

A. Welding in accordance with ANSI Standard B31 and AWS B3.0.

B. Install welding fittings on all welded lines. Make changes in direction and intersection of lines with welding fittings. Do not miter pipes to form elbows or notching of straight runs to form tees, or any similar construction. Do not employ welder who has not been fully qualified in above specified procedure and so certified by approved welding bureau or similar locally recognized testing authority.

3.03 FLANGED JOINTS:

Make flanged joints with bolts; bolt studs with nut on each end; or studs with nuts where one flange is tapped. Use number and size of bolts conforming to same ANSI Standard as flanges. Before flanged pieces are assembled, remove rust resistant coating from machined surfaces, clean gaskets and smooth all burrs and other defects. Make up flanged joints tight, care being taken to prevent undue strain upon valves or other pieces of equipment.
3.04 SLEEVE COUPLINGS:

Install tie rods, pipe clamps or bridles when sleeve type couplings or fittings are used in piping system where indicated, and at changes in direction or other places as necessary, to prevent joints from pulling apart under pressure. Use bridles and tie rods at least 3/4-in in diameter, except where tie rods replace flange bolts of smaller size, in which case fit with nut on each side of pair of flanges. Joint harnessing shall conform, as a minimum, to the requirements for the bolts and tie bolt lugs as set forth in AWWA Manual M11.

3.05 WALL SLEEVE SEALS:

Use expandable rubber segmented sealing device as specified in Section 15053 with stainless steel fasteners to make watertight the annular space between pipe and sleeve. Determine the required inside diameter of each individual wall opening or sleeve to fit the pipe and seal to assure a watertight joint as recommended by the manufacturer, before ordering, fabricating or installing. Install pipe concentrically through wall sleeve. Install and tighten seal per manufacturer's instructions.

3.06 TESTING:

A. Test all pipelines for water/gas tightness as specified in this Section, Section 15052, and other sections of Division 15. Furnish all labor, testing plugs or caps, pressure pumps, pipe connections, gages, and all other equipment required. Testing shall be performed in accordance with one or more of the testing procedures appended to this Section as specified in each Piping or System Section. All testing shall be performed in the presence of the Engineer or Engineer's Representative.

B. Repair faulty joints or remove defective pipe and fittings and replace as approved by the Engineer. Retest.

3.07 INSTALLATION OF PIPING INSULATION:

A. Omit the specified insulation at pipe supports and substitute rigid insulation such as cellular glass, calcium silicate, or expanded silica with a protective metal shield of a thickness and length as specified in MSS bulletin SP-69 Table 4. Secure the shield with at least three 1/2-in aluminum bands. Where piping is supported by roller hangers insulation saddles shall be installed.

B. Vapor seal adhesive shall be used to seal seams and to butt sections on all cold piping if self sealing laps are not provided. The use of staples or any other fastening method that would penetrate the vapor barrier will not be permitted on cold piping systems. Staples may be used on hot piping systems where there is no potential for condensation.
C. Where piping is provided with electric heat tracing the insulation shall not be installed until the heat tracing has been tested and accepted. Insulation shall be sized to allow for the heat tracing line without deforming the insulation.

D. On vertical risers exceeding 15-ft in height, provide intermediate support for the insulation. For carbon steel pipe, this support shall consist of angle clips or other suitable devices welded to the pipe at about 15-ft on centers and concealed by the pipe covering. On non-carbon steel piping, clamps or other non-welded devices shall be used.

E. Unless otherwise specified insulate all valves, control valves, fittings, pipe specialties and all other components that could be construed as being part of the piping system. Insulate valve bonnets to a point just below the stuffing box.

F. Bridge flanges, unions, and pipe line strainers with block or sectional insulation wired in place. Wire shall be black steel, annealed. Stop the pipe insulation a sufficient distance to allow removal of flange bolts without disturbing the pipe insulation and extend the block, at least 2-in over the adjacent pipe insulation. Fill voids with blanket insulation.

END OF SECTION
SECTION 15988

PIPE TESTING – GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE:

This Section specifies the general requirements for testing the various piping systems shown on the Drawings and specified elsewhere in these Specifications. Refer to Piping and System Section specs for actual test parameters.

1.02 RELATED WORK:

Pipe, joints, piping systems and appurtenances are specified in other Sections of Division 2 and 15.

1.03 SUBMITTALS:

A. Test Records

1. Records shall be maintained of all tests performed.
2. Test records shall include:
   a. Date of Testing
   b. Identification of Piping Tested
   c. Test Fluid
   d. Test Pressure
   e. Signature of Contractor
3. If leaks are found, they shall be noted, on the record. After correction, retest as specified for original test.
4. Records of test shall be maintained by the Contractor and 4 copies furnished to the Engineer.

1.04 REFERENCE STANDARDS:

A. American National Standards Institute (ANSI)
   ANSI B31 - Code for Pressure Piping, B31 Interpretation.

B. American Society of Testing Materials (ASTM)
   ASTM F1417 - Standard Test Method for Installation and Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.
PART 2 - PRODUCTS

2.01 TEST FLUIDS:

Hydrostatic Test – Potable water should be used as the test fluid only.

Service Pressure Test – Potable water should be used as the test fluid only.

Pneumatic Test - Compressed air shall normally be used. Other gases may be used when specified or directed by the Engineer. Test Pressure shall be per ASTM F1417.

2.02 TEST EQUIPMENT:

A. Hydrostatic Test

1. Water - Of sufficient capacity to deliver the required test pressure.
2. Strainer - On inlet side of the pump to prevent foreign matter from entering the system.
3. Valves - Shall be provided on the suction and discharge side of the pump.
4. Heater - To allow heating of the test fluid when elevated temperatures are required for test.
5. Relief Valve - Set at a pressure to relieve at 20 to 25 percent above the required test pressure.
6. Pressure Gage(s) - Capable of reaching 50 percent over the test pressure. These should be located at the pump discharge and any other place deemed convenient by the Contractor.
7. Pressure gages and relief valves shall be checked for accuracy before use in test procedures.

B. Service Pressure Test

1. A pressure gage capable of registering 25 psi over the design pressure shall be installed down-stream from the supply shut-off valve if one is not included in the system.

C. Pneumatic Test

1. Building supply air to deliver the required test pressure if available, or provide a compressor capable of the required test pressure.
2. Valves shall be provided on the discharge side of the pump.
3. Relief valve to relieve at 10 - 15 percent over the test pressure.
4. Pressure gage(s) capable of reaching 50 percent over the test pressure. A gage shall be located on the pump discharge and other location as required.
PART 3 - EXECUTION

3.01 HYDROSTATIC TEST:

A. This test specification shall be used to hydrostatically test piping systems for structural integrity and leaks. The test shall be performed at ambient temperature unless otherwise specified.

B. Preparation for Test:

1. Determine the fluid to be used for the test, and, if other than ambient temperature is required, what the test temperature will be.
2. When a fluid other than water is used for a test, the equipment used for the test shall be of a material compatible with the test fluid. Normally this would be equal to the piping material.
3. Vents shall be provided at the high points of the system and drains provided where means of venting or draining do not exist.
4. Remove or block off, all relief valves, rupture discs, alarms, control instruments, etc. that shall not be subjected to the test pressure.
5. All discs, balls, or pistons from check valves shall be removed if they interfere with filling of the system. Open all valves between inlet and outlet of the section to be tested.
6. Connect pump and provide temporary closures for all of the external openings in the system. Use caution to insure that the closures are properly designed and strong enough to withstand the test pressure.
7. All joints, including welds, are to be left uninsulated and exposed for examination during test.
8. A joint previously tested in accordance with this specification may be covered or insulated.
9. Piping designed for vapor or gas shall be provided with additional temporary supports, if necessary, to support the weight of the test liquid.
10. Expansion joints shall be provided with temporary restraint for additional pressure under test or shall be isolated from the test.
11. Flanged joints, where blanks are inserted to isolate equipment during the test, need not be tested.

C. The hydrostatic test pressure shall be 1-1/2 times the design pressure unless otherwise specified in the System Specification Section.

D. Test Procedures

1. Allow the test fluid to enter the system. Open vents to allow displacement of all entrapped air. For all pipelines exceeding 500-ft in length, the maximum rate of filling shall be limited to that which produces a maximum nominal flow velocity of one foot per second in the pipe to be tested.
2. Close vents and restrict personnel in the test area to those involved in the test.
3. Raise the pressure slowly with the pump until the predetermined test pressure is reached. Maintain pressure for duration of time specified in System Specification Section, keeping personnel at a safe distance.
4. Reduce the pressure about 20 percent and hold it at that point while the entire system is carefully inspected for leaks, cracks, or other signs of defects.
5. If defects are found, the pressure shall be released, the system drained, the defects corrected and the test repeated.
6. After a satisfactory test has been completed, the line shall be drained.

E. Flushing

1. Lines tested with potable water shall be completely drained.
2. Lines shall be flushed with potable water, after test.

3.02 SERVICE PRESSURE TEST:

A. This test specification shall be used to test piping systems using service pressure and the fluid for which the system is used. It shall not be used to test piping systems conveying combustible or flammable liquids or systems that comply with ANSI B31 codes. Insulated lines shall have all joints left exposed until completion of the test.

B. The test pressure shall be equal to the maximum pressure that the line will be subjected to under normal operating conditions as determined by the Engineer.

C. Test Procedures

1. Liquids
   a. See that all personnel not involved in the test vacate the area.
   b. Allow the system fluid to enter the system slowly while venting the air at the extreme far and uppermost points. For all pipelines exceeding 500-ft in length, the maximum rate of filling shall be limited to that which produces a maximum nominal flow velocity of one foot per second in the pipe to be tested.
   c. When the system is full and all air is vented, close the vents.
   d. Allow the pressure in the system to build up to the full line pressure.
   e. Inspect entire system for leaks.

2. Gas or Vapor (Including Compressed Air and Steam)
   a. See that all personnel not involved in the test vacate the area.
b. In systems that do not have a pressure gage near the main shut-off valve, a gage shall be installed.
c. Allow the system fluid to enter the system slowly until the full operating pressure is reached.
d. Shut off main supply valve. Observe the gage for 15 minutes. The pressure gage shall not drop during this time.
e. If the gage drops, indicating the presence of leaks, the systems shall be inspected visually and, if necessary, with soap suds or commercially available leak detectors to locate the leak(s).

3. If leaks are found, the lines shall be relieved of pressure, purged if necessary and repaired. Tests shall be repeated for repaired sections.

3.03 PNEUMATIC TEST:

This procedure for a pneumatic test of piping systems shall be used for all gravity sewer lines. The Contractor is responsible for all costs associated with testing.

A. Safety

1. All pneumatic tests shall be done under the supervision of Contractor and in the presence of the Owner.
2. Only those people actively participating in the test shall be allowed in the test area.
3. Safety glasses and hard-hats must be worn.

B. Test Procedures

Test procedure shall be per ASTM F1417 - Standard Test Method for Installation and Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air, latest revision.

3.04 CHLORINATION OF POTABLE WATER PIPELINE:

A. Before being placed in service, all new potable water pipelines shall be chlorinated in accordance with AWWA C601, “Standard Procedure for Disinfecting Water Mains.” The approval of the procedure by the Engineer shall be obtained in advance.

B. The location of the chlorination and sampling points shall be determined under this Section.

C. The general procedure for chlorination shall be first to flush all dirty or discolored water from the lines, and then introduce chlorine in approved dosages through a tap at one end to obtain a chlorine residual of 50 mg/l, while water is being
withdrawn at the other end of the line. The chlorine solution shall remain in the pipeline 24 hours.

D. Following the chlorination period, all treated water shall be flushed from the lines at their extremities, and replaced with water from the distribution system. Bacteriological sampling and analysis of the replacement water may then be made by the Owner in full accordance with AWWA Standard C601. Rechlorination will be required, if necessary and the line shall not be placed in service until the requirements of the State Regulatory Agency are met.

E. Special disinfecting procedures shall be used in connections to existing mains, and where the method outlined above is not practical.

F. Chlorinated water and other water used for flushing shall be directed to the treatment plant influent or shall be dechlorinated and discharged as directed by the Engineer. No discharges shall be permitted to surface waters, streams, drainageways or storm drains.

END OF SECTION
SECTION 15994

DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Furnish all labor, materials, equipment and incidentals required, install, and test ductile iron pipe and fittings for plant mechanical piping as shown on the Drawings and as specified herein.

B. Mechanical piping shall include all piping and fittings installed above grade, in utility tunnel or gallery and shall exclude pipe in valve vaults, manholes, cleanouts and similar yard structures.

C. Mechanical piping shall be installed as shown on the Drawings. Provide pipe supports, hangers and couplings as required to achieve a complete pipe system.

D. Where the word "pipe" is used, it shall refer to pipe, fittings, or appurtenances unless otherwise noted.

1.02 RELATED WORK:

A. General Piping Requirements are included in Section 15987.

B. Valves and Appurtenances are included in Section 15996.

C. Hydrostatic Testing is included in Section 15988.

1.03 DESCRIPTION OF SYSTEMS:

A. Piping shall be installed in those locations as shown on the Drawings.

B. The equipment and materials specified herein are intended to be standard types of ductile-iron pipe and ductile-iron fittings for use in transporting wastewater and water.

1.04 SUBMITTALS:

A. Shop drawings and product data shall be submitted in accordance with Sections 01500 and 15987 for Engineer's review. Shop drawings shall include piping layouts and schedules, dimensioning, fittings, locations of valves and appurtenances, joint details, methods and locations of supports and all other pertinent technical specifications for all piping to be furnished.

B. Shop drawing submittals for piping under this Section shall include all data and information required for the complete piping systems. All dimensions shall be based on the actual equipment to be furnished. Types and locations of pipe hangers and/or supports shall be shown on the piping layouts for each piping submittal.
C. Prior to shipment of pipe, submit a certified affidavit of compliance from the pipe manufacturer stating that the pipe, fittings, gaskets, linings and exterior coatings for this project have been manufactured and tested in accordance ANSI/AWWA and ASTM standards and requirements specified herein.

1.05 REFERENCE STANDARDS:

A. American Society for Testing and Materials (ASTM)
   1. ASTM A377 - Standard Index for Specification for Ductile-Iron Pressure Pipe

B. American National Standards Institute (ANSI)
   1. ANSI B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form).
   3. ANSI B18.2 - Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws.

C. American Water Works Association (AWWA)
   1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
   2. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3-In Through 48-In (75mm Through 1200mm) for Water and Other Liquids.
   4. AWWA C115 - Flanged Ductile-Iron Pipe with Threaded Flanges.
   5. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
   6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast for Water or Other Liquids.
   7. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
   8. AWWA C606 - Grooved and Shouldered Joints.
   9. AWWA C651 - Disinfecting Water Mains.

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.06 QUALITY ASSURANCE:
A. Each length of ductile iron pipe supplied for the project shall be hydrostatically tested at the point of manufacture to 500 psi for a duration of 10 seconds per AWWA C151. Testing may be performed prior to machining bell and spigot. Failure of ductile iron pipe shall be defined as any rupture of the pipe wall. Certified test results shall be furnished in duplicate to the Engineer prior to time of shipment.

B. All ductile-iron pipe and fittings to be installed under this project shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. Furnish in duplicate to the Engineer sworn certificates of such tests and their results prior to the shipment of the pipe.

C. All pipe and fittings to be installed under this Contract may be inspected at the plant for compliance with these Specifications by an independent testing laboratory selected by the Owner, at the Owner's expense.

D. Inspection of the pipe and fittings will also be made by the Engineer or representative of the Owner after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though sample pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the job.

E. All pipe and fittings shall be permanently marked with the following information:
   1. Manufacturer, date.
   2. Size, type, class, or wall thickness.
   3. Standard produced to (ANSI/AWWA, ASTM, etc).

1.07 DELIVERY, STORAGE AND HANDLING:

A. See Section 01500 for general requirements.

B. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe or coatings. Under no circumstances shall the pipe be dropped or skidded against each other. Slings, hooks, or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or internal lining of the pipe.

C. Materials, if stored, shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt or foreign matter at all times.

D. Pipe shall not be stacked higher than the limits recommended by its manufacturer. The bottom tier shall be kept off the ground on timbers, rails, or concrete. Stacking shall conform to manufacturer's recommendations.
PART 2 - PRODUCTS

2.01 MATERIALS:

A. Pipe
   1. Ductile iron pipe shall conform to AWWA C115, C110 and C151 standards. Flanged pipe shall be Thickness Class 53 as per AWWA C150.
   2. Pipe shall be supplied in standard lengths as much as possible.
   3. Ductile iron pipe shall be as manufactured by U.S. Pipe and Foundry Company, Inc.; American Cast Iron Pipe Company or equal.

B. Joints
   1. Ductile iron pipe shall have flanged joints. Flange shall be flat face type, unless otherwise noted, meeting requirements of ANSI B16.1 Class 150.
   2. Flange gasket shall be full face type per AWWA C111 to provide positive sealing for the flanged ductile iron joints. Thickness shall be 1/8-in unless otherwise indicated.
   3. Assembly bolts shall be square headed carbon steel machine bolts with hexagon nuts per ANSI B18.2. Thread shall conform to ANSI B1.1. Bolt length shall be such that after joints are assembled, the bolts shall protrude through the nuts, but not more than 2-in.
   4. Grooved joints shall conform to AWWA C606 standard flexible couplings and shall be Style 31 couplings as manufactured by Victaulic Company of America or equal.
   5. Sleeve type couplings shall be Dresser Style 38 or 138 as manufactured by Dresser Industries or equal.
   6. Flanged coupling adaptors shall be Smith-Blair Type 913 or equal.

C. Fittings
   1. Pipe fittings shall be ductile iron with a pressure rating of 150 psi. Fittings shall meet the requirements of AWWA C110 as applicable. Fittings shall have the same pressure rating, as a minimum, of the connecting pipe.

D. Interior Lining
   1. Ductile iron pipe and fittings shall be bituminous coated on the outside and lined with Protecto 401 Ceramic Epoxy in the inside.
   2. Coating on the outside shall be asphaltic coating approximately 1 mil thick. The finished coating shall be continuous, smooth, neither brittle when cold or sticky when exposed to the sun, and shall be strongly adherent to the iron.

4. The interior of the pipe shall receive 40 mils nominal dry film thickness of Protecto 401. Lining application, inspection, certification, handling and surface preparation of the area to receive the protective coating shall be in accordance with the Protecto 401 manufacturer specification and requirements.

**E. Exterior Coatings**

1. Unless otherwise specified, all exposed exterior ferrous surfaces shall be painted with an applicable paint system as specified under Division 9. Surface preparation and application thereof shall be in conformance with applicable provisions of Division 9.

2. All pipe and fittings exposed to view in the finished work shall not receive the standard asphalt coating but shall be primed on the outside in accordance with Section 09900. All other pipe and fittings shall be shop coated on the outside with bituminous coating in accordance with the above referenced specifications and will not require any other coating. If it is necessary to use bituminous coated pipe in exposed areas, the coating shall be completely removed by blast cleaning and the cleaned surfaces shall be immediately primed as specified in Section 09900.

**F. Pipe Hangers and Supports**

1. Pipe hangers and supports shall be provided at suitable distance along the pipeline regardless whether they are shown or not shown on the Drawings.

2. Pipe hangers and supports shall be as specified in Section 15140.

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**PART 3 - EXECUTION**

**3.01 PIPE INSTALLATION:**

**A. General**

1. All piping and fittings shall be installed true to alignment and rigidly supported. Anchorage shall be provided where required. Any damage to linings shall be repaired to the satisfaction of the Engineer before the pipe is installed. Each length of pipe shall be cleaned out before installation. All of manufacturer's recommendations shall be complied with.

2. The deflection at joints shall not exceed that recommended by the pipe manufacturer. Fittings, in addition to those shown on the Drawings, shall be provided, if required, in areas where conflict exists with the existing facilities.

3. When pipe cutting is acceptable to the Engineer, the cutting shall be done by abrasive saw, leaving a smooth cut at right angles to the axis of the pipe. Any damage to the lining shall be repaired to the satisfaction of the Engineer. Field cut ends shall be sealed with Protecto 401(or for potable water, approved epoxy) in accordance with manufacturer=s instructions.
4. Ductile iron and fittings shall be installed in accordance with requirements of AWWA C600 modified.

B. Jointing

1. Flanged joints shall be made using gaskets, bolts, bolt studs with a nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same ANSI Standard as the flanges.

2. Bolts in flanged joints or mechanical joints shall be tightened alternately and evenly.

3. Sleeve type couplings and grooved joints using split ring couplings shall be installed in accordance with the procedures recommended by their respective manufacturers.

C. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, submit a certification stating that such requirements have been complied with.

D. Sleeves of proper size shall be installed for all pipes passing through floors or walls. Sleeves shall be as specified in Section 15053.

E. Sleeves and wall pipes shall have thrust collar located at the mid-depth of wall as described in Section 15053.

F. Concrete inserts for hangers and supports shall be furnished and installed as recommended by the manufacturer or as specified herein or as shown on the Drawings. The inserts shall be set in accordance with the requirements of the piping layout and the Contractor shall verify their locations from approved piping layout drawings and the structural drawings.

3.02 TESTING:

A. All piping shall be subject to acceptance tests as described in Section 15052. Provide all necessary utilities, labor and equipment for flushing and testing and dispose all waste after the test including water.

B. All pipe and fittings shall be pressure tested as described in Section 15052 using water to 1.5 times the working pressure.

C. Correct any leakage and repair any damage to the pipe and pipe appurtenances or to any structures resulting from, or caused by tests. All leaks shall be repaired and lines retested.

3.03 CLEANING:

Clean all of the pipe by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered during the construction period. All debris shall be removed from the pipeline. The lowest segment outlet shall be flushed last to assure debris removal.
3.04  PIPE MARKING:

All exposed piping exterior and interior shall be marked in accordance with the requirements of Section 09900.

END OF SECTION
SECTION 15996

VALVES

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Furnish all labor, materials, equipment and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Drawings and as specified herein.

B. All valves complete with automatic operator as required shall be furnished by a single manufacturer and shall be coordinated with instrumentation and controls furnished under Sections 13600 and 13615.

C. The equipment shall include, but not be limited to, the following:
1. Valve operators (including floor boxes)
2. Gate valves
3. Ball valves for P.V.C. pipe
4. Ball valves
5. Check valves
6. Automatic Control Check Valve
7. Butterfly valves
8. Knife Gate Valve
9. Diaphragm valves
10. Plug valves
11. Needle valves
12. Stem Guides
13. Air release valves
14. Air Inlet Valves
15. Pressure reducing valves
16. Surge Relief Valve
17. Air Pressure Regulation Station
18. Solenoid valves
19. Valve boxes
20. Corporation cocks
21. Expansion joints
22. Flanged adapters
23. Flexible couplings
24. Flexible connectors
25. Strainers
26. Rotameter
27. Diaphragm seals
28. Pressure switches
29. Unions
30. Hose bibs
31. Pressure Gauges
32. Mud Valves
33. Telescoping Valves
34. Floor Type Pressure Relief Valve
35. Pipe Sleeve Seals
36. Backflow Preventer
37. Pressure Sensors

1.02 RELATED WORK:

A. Yard piping and valves are included in Division 22 and 15.

B. Pipe Hangers and supports are included in Section 15999.

C. Instrumentation and Electrical, not specified herein, are included in Divisions 13 and 16.

D. Valve tags are included in Division 1.

E. Field painting is included in Section 09900.

F. Slide Gates are included in Division 11.

G. Certain appurtenances for individual types of pipe or systems are specified with the specific type of pipe or system. However, additional items are specified in this Section.

H. Certain items similar to those specified in this Section may be specified to be furnished and installed with the individual equipment or systems. In case of conflict, those individual equipment or system requirements shall govern.

I. Electric valve operators of all types, rate of flow controllers (including modulating valves and operators) and other types of valves, which are part of the automated instrumentation (such as some solenoid valves) if not included herein are included in Division 13. Valve operators shall, however, be mounted at the factory on the valves as specified herein, as part of the Work of this Section.

J. Buried valves and appurtenances are included in Division 2 and 15.
1.03 SUBMITTALS:

A. Submit materials required to establish compliance with these Specifications in accordance with Section 01500. Submittals shall include the following:

1. Certified drawing showing all important details of construction and dimensions.
2. Descriptive literature, bulletins and/or catalogs of the equipment.
3. The total weight of each item.
5. Additional submittal data, where noted, with individual pieces of equipment.

B. Test Reports

Provide certified hydrostatic test data, per manufacturer’s standard procedure or MSS-SP-61 for all valves.

C. Certificates

For each valve specified to be manufactured, tested and/or installed in accordance with AWWA and other standards, submit an affidavit of compliance with the appropriate standards, including certified results of required tests and certification of proper installation.

D. Manufacturer’s Installation and Application Data

E. Operating and Maintenance Data

Operating and maintenance instructions shall be furnished to the Engineer as provided in Section 01900. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions and other information required to instruct operating and maintenance personnel unfamiliar with such equipment.

1.04 REFERENCE STANDARDS:

A. American Society for Testing and Materials (ASTM)
Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.


9. ASTM B62  Standard Specification for Composition Bronze or Ounce Metal Castings

B. American Water Works Association (AWWA)
   1. AWWA C111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   2. AWWA C500 Metal-Seated Gate Valves Supply Service.
   3. AWWA C504 Rubber-Seated Butterfly Valves.
   4. AWWA C507 Ball Valves, 6-in Through 48-inch (150mm Through 1200mm).
   5. AWWA C508 Swing-Check Valves for Waterworks Service, 2-inch (50mm Through 24-inch 600mm) NPS
   6. AWWA C509 Resilient-Seated Gate Valves for Water and Supply Service
   7. AWWA C511 Reduced-Pressure Principle Backflow-Prevention Assembly
   8. AWWA C540 Power-Actuating Devices for Valves and Sluice Gates
   9. AWWA C550 Protective Epoxy Interior Coatings for Valves and Hydrants
   10. AWWA C800 Underground Service Line Valves and Fittings.

C. American National Standards Institute (ANSI)
   1. ANSI B2.1  Specifications, Dimensions, Gauging for Taper and Straight Pipe Threads (except dry seals).
   2. ANSI B16.1  Cast Iron Pipe Flanges and Flanged Fittings
   3. ANSI B16.10  Face-to-Face and End-to-End Dimensions of Valves
   4. ANSI B16.104  Butterfly Valves

D. American Iron and Steel Institute (AISI)

E. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)
   1. MSS-SP-61  Pressure Testing of Steel Valves.
   2. MSS-SP-67  Butterfly Valves.
   3. MSS-SP-70  Cast Iron Gate Valves, Flanged and Threaded
4. MSS-SP-71 Cast Iron Swing Check Valves, Flanges and Threaded Ends.
5. MSS-SP-72 Ball Valves with Flanged or Butt-Welding Ends for General Services.
6. MSS-SP-78 Cast Iron Plug Valves, Flanged and Threaded Ends.
7. MSS-SP-80 Bronze Gate, Globe, Angle and Check Valves.
8. MSS-SP-82 Valve Pressure Testing Methods.
9. MSS-SP-98 Protective Epoxy Coatings for the Interior of Valves and Hydrants.

F. National Electrical Manufacturers Association (NEMA)
G. Underwriters Laboratories (UL)
H. Factory Mutual (FM)
I. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE:

A. Qualifications
   1. Valves and appurtenances shall be products of well established firms who are fully experienced, minimum five (5) years, reputable and qualified in the manufacture of the particular equipment to be furnished.
   2. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.
   3. All units of the same type shall be the product of one manufacturer.

B. Certifications
   1. The manufacturers shall furnish an affidavit of compliance with Standards referred to herein as specified in Paragraph 1.03C. Refer to PART 3 for testing required for certain items in addition to that required by referenced standards.

C. Provide the services of a qualified and factory-trained service representative of the manufacturer to provide operational and maintenance instruction, for a one-day, eight hour period for:
   1. Valve motor operators.
   2. Pressure regulating valves.
   3. Air release, air and vacuum valves.
4. Surge relief valves.
5. Cone valves.
6. Dashpot-style check valves.

D. Inspection of the units may also be made by the Engineer or other representative of the Owner after delivery. The equipment shall be subject to rejection at any due to failure to meet any of the Specification requirements, even though submittal data may have been accepted previously. Equipment rejected after delivery shall be marked for identification and shall be removed from the job site at once.

1.06 SYSTEM DESCRIPTION:

A. All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of wastewater, sludges, air and chemicals, raw, filtered and finished water as noted on the Drawings.

B. Valves, appurtenances and miscellaneous items shall be installed as shown on the Drawings and as specified, so as to form complete workable systems.

C. Unless otherwise noted all powered valve operators shall have:
   1. Valves larger than 3 inches:
      a. electric operators 460 volt, 3 phase, 60 hz.
   2. Solenoid valves:
      a. 110 volt, single phase, 60 hz, NEMA 4 enclosure, continuous duty Class F coils and manual operator.
   3. See other paragraphs for additional requirements.

1.07 DELIVERY, STORAGE AND HANDLING:

A. Reference is made to Section 01900 for additional information.

B. Packing and Shipping
   1. Care shall be taken in loading, transporting and unloading to prevent injury to the valves, appurtenances, or coatings. Equipment shall not be dropped. All valves and appurtenances shall be examined before installation and no piece shall be installed which is found to be defective. Any damage to the coatings shall be repaired as acceptable to the Engineer.
   2. Prior to shipping, the ends of all valves shall be acceptably covered to prevent entry of foreign material. Covers shall remain in place until after installation and connecting piping is completed.
      a. All valves 3 inches and larger shall be shipped and stored on site until time of use with wood or plywood covers on each valve end.
      b. Valves smaller than 3 inches shall be shipped and stored as above except that heavy cardboard covers may be used on
the openings.

c. Rising stems and exposed stem valves shall be coated with a protective oil film which shall be maintained until the valve is installed and put into use.

d. Any corrosion in evidence at the time of acceptance by the Owner shall be removed, or the valve shall be removed and replaced.

C. Storage and Protection
1. Special care shall be taken to prevent plastic and similar brittle items from being directly exposed to the sun, or exposed to extremes in temperature, to prevent deformation. See the individual piping specifications and manufacturer's information for further requirements.

1.08 MAINTENANCE:

A. Special tools and the manufacturer's standard spare parts, if required for normal operation and maintenance, shall be supplied with the equipment where noted and as specified herein.

B. Provide all special tools required for normal maintenance. Tools shall be packaged in a steel case, clearly and indelibly marked on the exterior to indicate equipment for which tools are intended.

C. Provide to the Owner a list of all spare and replacement parts with individual prices and location where they are available. Prices shall remain in effect for a period of not less than one year after start-up and final acceptance.
PART 2 - PRODUCTS

2.01 GENERAL:

A. All valves and appurtenances shall be of the size shown on the drawings and shall be from one manufacturer.

B. All valves and appurtenances shall have the name of the maker and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

2.02 GATE VALVES:

A. Gate valves unless otherwise specified or approved, shall be ductile iron body, bronze mounted, resilient wedge gate valves with flanged ends and rated for 250 psig cold water pressure conforming to the AWWA Standard for Gate Valves for Ordinary Water Works Service, Designation C515, insofar as applicable.

B. Exposed valves shall be outside screw and yoke type and buried valve shall be non-rising stem with 2-inch square cast iron wrench nuts.

C. Face to face dimension shall conform to ANSI Standard Face to Face and End to End Dimensions of Ferrous Valves, (ANSI 816.10) for 125 pound cast-iron valves.

D. Handwheels or chain wheels shall be turned counterclockwise to open the valves. Handwheels shall be of ample size and shall have an arrow and the word OPEN cast thereon to indicate the direction of opening.

E. Stuffing box follower bolts shall be of steel and the nuts shall be of bronze.

F. The design of the valves shall be such as to permit packing the valves without undue leakage while they are wide open and in service. O-ring stuffing boxes may be used.

G. Valves 16 inches or larger shall be provided with bevel or spur gears depending on the position of the main valve as indicated on the Drawings. The gear cases shall be of the extended type to permit repacking the stuffing box of the valve without disassembly. Valves 16 inches or larger designed to lie horizontally shall be equipped with rollers or shoes to carry the weight of the wedge throughout its travel.

H. Where indicated on the Drawings or necessary due to location, size, or inaccessibility, chain wheel operators shall be furnished with the valves.
Such operators shall be designed with adequate strength for the valves with which they are supplied and to provide for easy operation of the valve. Chains for valve operators shall be galvanized.

I. Where required gate valves shall be provided with a box cast in the slab and a box cover. Length of box shall be slab thickness. Box cover opening shall be for valve stem and nut. Valve wrenches and the valves. The floor box and cover shall be equal to those manufactured by American Flow Control Series 2500, Clow, or equal.

2.03 BALL VALVES FOR PVC PIPE:

A. Ball valves for PVC pipe shall be of PVC Type 1 with union, socket, threaded or flanged ends as required. Ball valves shall be full port, full flow, all plastic construction, 150 psi rated with teflon seat seals, O-ring and T-handles. Valves shall be double (true) union type. PVC ball valves shall be as manufactured by Celanese Piping Systems, Inc., Wallace and Tiernan Inc., Plastil ine, Inc., or equal.

B. All valves shall be mounted in such a position that valve position indicators are plainly visible when standing on the floor.

2.04 BALL VALVES (3 inches and smaller):

A. Ball valves 3 inches and smaller shall be bronze, or carbon steel body; full bore, fire safe, rated for pressure of 250 psi. Valve ends shall be flanged, threaded, or soldered as required. All valves furnished shall be by the same manufacturers.

B. The design of the valve shall provide suitable seating in both directions. To compensate for wear on the seating surfaces, the valve shall utilize a separate ball and stem design which will allow the ball to float freely under pressure against the downstream seat and seal tightly under all service conditions. The stem shall be designed to prevent blowout. Ball valves shall have Type 316 stainless steel balls and trim, RTFE seats and RTFE stem packing.

C. The valves shall not require lubrication but shall have stuffing boxes which can be packed with the valve in service without undue leakage.

D. Valves shall be furnished with lever actuator attached to each valve.

E. Valves shall be "Apollo" series as manufactured by Conbraco Industries, Inc.

2.05 CHECK VALVES:
A. Swing check Valve with Air Cushion Cylinder shall be constructed of heavy ductile iron body with a stainless steel body seat ring and single continuous stainless steel shaft for attachment of outside weight and lever and a totally enclosed air cushion cylinder. Cushion Chambers will not be accepted.

B. The valve shall prevent the return of water or sewage back through the valve on pump shut off or power failure and be tight seating. The seat ring much be renewable and securely held in place by stainless steel screws.

C. The cushion cylinder assembly shall be externally attached to the side of the valve body. The cylinder piston rod is connected to the external lever arm in a manner to lift the piston upwards when flow starts and downwards when the flow stops to compress the entrapped air in the cylinder for cushion closing. The cushion cylinder shall be fitted with an adjustable control valve to increase or decrease air compression in the cylinder.

D. The valve disc shall be ductile iron suspended form a stainless steel shaft which shall pass through a stuffing box and be connected to the cushion cylinder on the outside of the valve.

E. This valve shall be guaranteed for a period of one year against failure to operate due to faulty workmanship or defective material. The valve shall be APCO Series 250 Swing Check Valve with Air Cushion cylinder with ANSI 125/150# class flanges (rated for 250 PSI, flat faced standard(, as supplied by Valve & Primer Corp., Schaumburg, Illinois, U.S.A.

F. The valve shall have Stainless steel trim and cover bolts.

G. The valve shall have standard fusion bond epoxy lined (12 mils minimum) and coated (8 mils minimum).

H. Valve meets or exceeds AWWA C-508.

I. Valves shall be manufactured by DeZurik/APCO, GA Industries, or Engineer approved equal.

2.06 AUTOMATIC CONTROL CHECK VALVES (ACCV):

A. The ACCV shall have an electric motor operator for normal opening and closing operation. When the ACCV is operating as a pump control valve, it shall allow the pump to come on line against a closed control valve, which will then be allowed to open slowly so as to eliminate system surge pressure at pump start. The valve shall be capable of closing against the running pump and then be able to signal the pump controls to turn off the pump motor. This
feature will eliminate or minimize water hammer or pressure surge at pump shut down. The ACCV shall be capable of modulation service if equipped with an optional 4 to 20ma. control circuit feature.

B. The ACCV Pump Control Valve shall have a single “offset” pivoted disc above the centerline of the valve. This partially balanced design shall be capable of closing with minimal backflow and provide bubble tight shut-off. The valve shall have a non-slam closure feature without the need for any auxiliary power source supply, solenoid valves, or (oil, water or air) accumulator system. The offset pivot disc shall require minimal seating and unseating torques to prevent seat wear. The disc seat ring shall be bolted onto the disc, not welded, for ease of replacement in the field.

C. The ACCV shall be equipped with an electric motor driven power opening feature with a gear arrangement to provide for opening the valve against the down stream pressure to drain the line when desired.

D. The ACCV shall have a full flow area, designed to operate as a positive shut-off, throttling and/or check valve. The ACCV shall be controlled through a lost motion type of gear arrangement that is mounted on the side of the valve, totally enclosed in a lubricated gearbox. When operating as a check or throttling valve, the opening and closing speeds shall be controlled hydraulically by means of an oil dashpot system with speed control valves. This system shall be connected to the lost motion gear system and provide an independent adjustment of the opening and closing speeds.

E. The ACCV must be fail-safe during any electrical power failure, and the disc shall close hydraulically, energized only by the flow reversal in the line. The time of this disc closure shall be adjustable from 3 seconds to 45 seconds, by means of a cam operated (dump type) timing valve, permitting instant first stage closure to any degree, and then the hydraulic dashpot allows the second and third stage control towards final closure.

F. The ACCV body shall be of two (2) piece design, bolted together in a manner to capture the seat and be of an enlarged globe style through the disc section to create a 100% flow area to minimize head loss. The body shall have a built-in stop to positively prevent the disc from over-traveling the shutoff position. The body seat and disc ring must be hand replaceable in the field without the need for special tools, machining, or the need for removing the complete valve from the line. The seat material shall be precision molded Buna-N, reinforced with a heavy steel insert collar.

G. The valve shaft shall be of one-piece Type 17-4PH stainless steel material and extend completely through the valve disc and into the gearbox. (Not stub shafts)
H. Valve exterior shall be painted with a high build, corrosion resistant, alkyd resin primer, which is suitable for use in USDA, inspected facilities.

I. A computerized valve cavitation analysis will be required upon the engineer’s request.

J. Valve shall be manufactured by APCO, “Series 8000,” Adams Valves or engineer approved equal.

2.07 BUTTERFLY VALVES:

A. Butterfly valves and operators shall conform to the AWWA Standard for Rubber Seated Butterfly Valves, Designation C504, except as hereinafter specified. Valves, except as specified hereinafter, shall be Class 150B and manufactured by DeZurik, or Henry Pratt Company; or engineer approved equal. The valve discs shall be cast iron per ASTM A48 Class 40C or Ductile Iron per ASTM A536. The disc seating edge shall be solid 316 stainless steel. The disc shall be securely attached to the valve shaft utilizing a field removable/replaceable 316 stainless steel torque screw or a tangential pin locked in place with a set screw.

B. Valves shall have integrally cast mechanical joint ends or flanged ends. The face to face dimensions of flanged end valves shall be in accordance with Table 3 of above mentioned AWWA Standard for short-body valve. Adequate two-way thrust bearings shall be provided. Flange drilling shall be in accordance with ANSI B16.1.

C. Valve seats shall be a natural rubber or synthetic rubber compound. Valve seats 24 inches and larger shall be of Buna-N for water, or as required for other services, and shall be retained within a dovetail groove in the valve body and locked in place by an epoxy compound edge. Compression between the seat and disc edge shall be adjustable from both the upstream and downstream side of the valve disc and the seat shall be field replaceable without disassembly of the disc and shaft. Seats with unidirectional adjustment, seats retained in the valve body by the use of fasteners and/or retaining rings, and seats retained on the valve disc are not acceptable.

D. The valve body shall be constructed of close grain cast iron per ASTM A126, Class B with integrally cast hubs for shaft bearing housings of the through boss-type. Permanently self-lubricating corrosion resistant sleeve type bearings shall be provided and shall be sized to withstand bearing
loads. Bearing loads shall not exceed 1/5 of the compressive strength of the bearing or shaft material and shall not exceed 2,500 psi. Valve shaft seals shall be self-compensating V-type packing with a minimum of four sealing rings. One-piece molded shaft seals and o-ring shaft seals are not acceptable.

E. The valve shaft shall be turned, ground and polished constructed of 18-8 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design.

F. In general, the butterfly valve operators shall conform to the requirements of Section 3.8 of the AWWA Standard for Rubber Seated Butterfly Valves, Designation C504, insofar as applicable and as herein specified.

G. Gearing for the operators where required shall be totally enclosed in a gear case in accordance with Paragraph 3.8.3 of the above mentioned AWWA Standard.

H. The manual operators shall conform to Section 3.8.1 of the above mentioned AWWA Standard, insofar as applicable and handwheels shall turn clockwise to close the valves. Operators shall have indicators to show position of the valve disc. Operators shall be rigidly attached to the valve body or to its floor stand. Where operators are to be more than 6 feet above the operating floor chain wheels and operating chains shall be furnished.

I. Where indicated on the Drawings extension stems, floor stands, couplings, stem guides and floor boxes as required shall be furnished and installed. Double flange fabricated steel wall thimbles shall be provided for all rectangular butterfly valves.

2.08 KNIFE GATE VALVES (SSTL):

A. Valves shall be bonnetless knife gate

B. Valve face-to-face dimension shall meet TAPPI standard TIS 405-8 and MSS SP-81 for knife gate valves.

C. Cold Working Pressure valve rating shall be 150 psi (1030 kPa) per MSS SP-81Specification. Flange drilling shall be in accordance with ANSI B16.5 class 150.

D. Valve body shall be a one piece casting of type (304stainless steel for corrosive applications. Valve body shall incorporate cast in guides and jams rated to full reverse pressure. Valve inside port diameter shall be
equal to ANSI B36.10 STD pipe inside diameter for both metal and resilient seated valves.

E. Valve shall be resilient seated. Resilient seated valves shall have a stainless steel seat ring with a molded-in resilient insert bonded to the seat and gate side for installations where drip-tight shutoff is required. Resilient seat material shall be suitable for use with raw sewage.

F. The packing system shall fit a machined packing chamber. The packing system shall consist of multiple layers of packing. The selected packing system shall be for wet service. The packing gland shall be 316 stainless steel.

G. The fasteners shall be 316 stainless steel.

H. The gate edge shall be radiused and have a 45 degree beveled knife edge. The gate shall be finish ground. The stem shall be type 304 stainless steel.

I. Valves shall be model KGC by DeZurik, Red Valve or Engineer approved equal.

2.09 DIAPHRAGM VALVES (PVC):

A. Diaphragm valves shall be constructed of PVC material with Hypalon diaphragm. Valves shall be constructed so that diaphragms can be removed without removing valves from the line. Valve ends shall be flanged or threaded. If threaded ends are offered, the valves shall be installed with at least one union connection to the PVC piping.

B. The valves shall be Model 2406 or 2436 (screwed or flanged fittings) as manufactured by ITT Grinnell, Providence, R.I., equal by A. W. Cash Valve Mfg. Co., Decatur, Ill. or equal.

2.10 STANDARD PORT PLUG VALVES:

A. Plug valves shall be non-lubricated eccentric type with semi-steel bodies, resilient faced plugs, and welded nickel seats in the body. Port areas shall be at least 80 percent (80%) of full pipe area for valves 20 inches and smaller. Port area shall be 70 percent (70%) for all valves 24 inches and larger. All valves 4 inches and larger shall be of the bolted design. All exposed nuts, bolts, springs, and washers shall be hot dipped galvanized, except exposed hardware for submerged valves shall be of stainless steel. Valve bodies shall be semi-steel with 125-pound ANSI Standard flanged ends for interior or above ground service, mechanical joint for buried service, or for use with threaded cast iron or ductile iron piping shall have screwed end connections. The plug shall be one piece and of sufficient design so as not to require a
stiffening member opposite the face plug.

B. **Valves** shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanged valves shall be faced and drilled to the ANSI 125/150 lb. standard. Mechanical joint ends shall be to the AWWA Standard C111, grooved ends per AWWA C-606. Screwed ends shall be the NPT standard.

C. **Bodies** shall be of ASTM A126 Class B cast iron. Bodies in 4” (100mm) and larger valves shall be furnished with a 1/8” (3mm) welded overlay seat of not less than 90% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to insure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.

D. **Plugs** shall be of ASTM A126 Class B cast iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be Chloroprene (CR) or resilient facing suitable for application.

E. **Bearing** shall have sleeve type metal bearings and shall be of sintered, oil impregnated permanently lubricated type 316 ASTM A743 Grade CF8M in ½ -36” (15-900mm) sizes. In valves larger than 36” (900mm), the upper and lower plug journals shall be fitted with ASTM A-240 type 316 stainless sleeves with bearings of ASTM B30, Alloy C95400 aluminum bronze. Non-metallic bearings shall not be acceptable.

F. **Shaft seals** shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the actuator or bonnet from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.

G. **Pressure ratings** shall be 175 psi (1210 kPa) on sizes ½ -12” (15-300mm) and 150 psi (130 kPa) for 14-72” (350-1800mm). Every valve shall be given a hydrostatic and seat test results being certified when require by the specifications.

H. All valves 8 inches and larger shall be equipped with gear actuators. All gearing shall be enclosed suitable for running in oil with seals provided on all shafts to prevent entry of dirt and water into the actuator. All shaft bearings shall be furnished with permanently lubricated bronze bearing bushings. Actuator shall clearly indicate valve position and an adjustable stop shall be provided. Construction of actuator housing shall be semi-steel.
I. All valves and actuators shall be as manufactured by DeZurik Corporation (PEC series), or engineer approved equal.

2.11 100% PORT PLUG VALVES:

A. **Bodies** shall be of ASTM A126 Class B cast iron. Port shall be rectangular. Port area shall be 100% of Standard class pipe area. Bearings shall be sleeve type and made of sintered, oil-impregnated permanently lubricated type 316 stainless steel per ASTM A743 Grade CF8M.

B. **Seats** shall be 1/8” thick welded overlay of not less than 95% pure nickel. Seat shall be at least ½” wide and raised. The raised surface shall be completely covered with nickel to insure that the resilient plug face contacts only the nickel seat.

C. **Adjustable Packing** shall be of the multiple V-ring type, with a packing glad follower. Shaft seals shall permit inspection, adjustment or complete replacement of packing without disturbing any part of the valve or actuator assembly except the packing glad follower.

D. **Grit Excluders** made of PTFE Shall be provided to prevent the entry of grit and solids into the bearing areas.

E. **Pressure ratings** shall be bi-directional and 175 psi (1,207 kPa) on sizes 3”-12” (80-300mm) and 150 psi (1,034 kPa) for 14”-36” (350-900mm). Every valve shall be given a certified hydrostatic and seat test, with test reports being available upon request.

F. Plug valves installed such that actuators are 6 feet or more above the floor, shall have handlewheels.

G. Where shown on the Drawings plug valves shall be installed with extended shafts and actuators. Actuators for extended shafts shall be mounted on floor stands where indicated on the Drawings or shall be removable handwheels where floor stands are not called for. Six inch sleeves shall be provided for extended shafts in all floors; where necessary covers shall be provided. Shafts shall be of adequate strength to operate the valve. Floor stands and covers, where called for shall be cast iron. Floor stands shall be equipped with valve position indicators and a lock for the handwheel. Valve boxes for buried valves shall be as Specified herein.
H. All plug valves shall be installed so that the direction of flow through the valve is in accordance with the manufacturer's recommendations.

I. Valve shall be manufactured by DeZurik, Val-matic or engineer approved equal

J. Electric Operators:
   1. In general, electric plug valve operators shall conform to the requirements as herein specified.

   2. The motor operated valve actuator shall include the motor, operator unit gearing, limit switch gearing, limit switches, torque switches, bored and key-wayed drive sleeve for nonrising stem valves, declutched lever and auxiliary handwheel as a self-contained unit.

   3. The motor shall be specifically designed for valve operator service requiring electric power as shown on the electrical Drawings. The motor shall be sized per AWWA Standards for electric motor operators and shall be totally enclosed, non-ventilated type for outdoor service. The power gearing shall consist of generated helical gears of heat treated alloy steel forming the first stage of reduction. The second reduction stage shall be a worm and worm gear. The worm shall be of alloy steel with carburized threads hardened and ground for high efficiency. The worm gear shall be of high tensile strength bronze with bobbed teeth. All power gearing shall be grease lubricated. Ball or roller bearings shall be used throughout. Preference will be given to units having a minimum number of gears and moving parts. Spur gear reduction shall be provided as required.

   4. Limit switches and gearing shall be an integral part of the valve control. The limit switch gearing shall be made of bronze and shall be grease lubricated, intermittent type and totally enclosed to prevent dirt and foreign matter from entering the gear train. Limit switches shall be of the adjustable type capable of being adjusted to trip at any point between fully opened valve and fully closed valve.

   5. The speed of the operator shall be the responsibility of the system supplier with regards to hydraulic requirements and response compatibility with other components within the control loop. Each valve actuator shall be provided with a minimum of two rotor type gear limit switches, one (1) for opening and one (1) for closing. The rotor type gear limit switch will have two (2) normally open and two (2) normally closed contacts per rotor. Gear limit
switches must be geared to the driving mechanism and in step at all times whether in motor or manual operation. Provision shall be made for two additional rotors as described above each to have two normally open and two normally closed contacts. Each valve actuator shall be equipped with a double torque switch. The torque switch shall be adjustable and will be responsive to load encountered in either direction of travel. It shall operate during the complete cycle without auxiliary relays or devices to protect the valve should excessive load be met by obstructions in either direction of travel. The torque switch shall be provided with single-pole contacts.

6. A permanently mounted handwheel shall be provided for manual operation. The handwheel shall not rotate during electric operation, but must be responsive to manual operation at all times except when being electrically operated. The motor shall not rotate during hand operation nor shall a fused motor prevent manual operation. When in manual operating position, the unit will remain in this position until motor is energized at which time the valve operator will automatically return to electric operation and shall remain in motor position until handwheel operation is desired. This movement from motor operation handwheel operation shall be accomplished by a positive declutching level which will disengage the motor and motor gearing mechanically but not electrically. Hand operation must be reasonably fast. It shall be impossible to place the unit in manual operation when the motor is running. The gear limit switches and torque switches shall be housed in a single easily accessible compartment integral with the power compartment of the valve control. All wiring shall be accessible through this compartment. Stepping motor drives will not be acceptable.

7. All units shall have strip heaters in both the motor and limit switch compartments.

8. The operator shall be equipped with open-stop-close push buttons, a local-remote selector switch and indicting lights all mounted on the operator or on a separate locally mounted power control station.

9. Motor shall be designed for operation as shown on the Drawings. Operator shall be as manufactured by Rotork, EIM, or engineer approved equal and shall be mounted on a torque tube.

2.12 NEEDLE VALVES:
A. The needle valves shall have a cast bronze body and be constructed in accordance with ASTM B62 and shall be designed for an operating pressure of 125 psi and a 200 psi maximum test pressure. Ends shall be ANSI B2.1 threaded. The valves shall have a rising bronze stem and non-slip malleable iron hand wheel.

B. The needle valves shall be Figure 680 as manufactured by the Wm. Powell Company, Cincinnati, Ohio, or Figure 88 as manufactured by Crane Company, Valve Division, Chicago, Illinois, or equal.

2.13 STEM GUIDES:

Adjustable stem guides of the wall bracket type shall be provided as shown on the Drawings. The guide where the extension stem passes through shall be bronze bushed. Stem guide shall be Model F5660 as manufactured by Clow Corporation, Bensenville, Illinois, equal Rodney Hunt Company, Orange, Massachusetts, or equal.

2.14 AIR VALVES:

A. The air release valves for use in water mains shall be installed as shown on the Drawings. The valves shall have a cast iron body, cover and baffle, stainless steel float, bronze water diffuser Buna-N or Viton seat and stainless steel trim. Valves shall be provided with a vacuum check to prevent air from reentering the line. The fittings shall be 6” Flanged and have a 1” discharge orifice on the forcemain. The air release valves shall be Model 207 as manufactured by APCO Valve and Primer Corporation, Schaumburg, Illinois; Model 45VC by Val-Matic Valve and Manufacturing Corporation, Lyons, Illinois or engineer approved equal.

B. The Vacuum Relief/Air Inlet Valve shall have globe type body with integrally cast-on flanged ends. The valve shall have a cross-sectional inflow area 10% greater than equivalent pipe size for full vacuum relief protection during draining, pipeline rupture or water column separation. The Vacuum Relief/Air Inlet Valve will be covered by a steel hood to prevent debris entering.

The internal valve plug and seat shall be heavy cast bronze. The seat is retained in the body by a heavy cover having a (molded, not glued) resilient Buna-N seal, for positive shut-off. The plug is center guided on both ends to prevent jamming. The plug shall be normally closed, by means of a stainless spring and shall open when a vacuum/pressure differential exceeds 0.25 psi (2 kpa).

The Air Inlet Valve shall be model 1500 – Vacuum Relief / Air Inlet Valve (Flange Tpe) as manufactured by APCO Valve and Primer Corporation, Schaumburg, Illinois
C. The air release valves for use at the pump discharge shall be Slow Closing Air/Vacuum Valve shall be four valves furnished assembled and tested as a single unit. The Air/Vacuum Valve must have a stainless steel float guided at each end with stainless stems. The stems shall be guided through stainless steel bushings inside the body and cover. The seat* must be Buna-N fastened to the cover with stainless shoulder screws without distortion to allow drop tight closure.

The cover shall have a male lip to fit the female body register for positive float guide direction into the seat. Cover outlets may be threaded, flanged, or hooded. (Engineer to specify.)

The Surge Check Valve shall be a normally open spring loaded valve consisting of a body, seat and plug bolted to the inlet of the Air/Vacuum Valve. The surge check shall operate on the interphase between the kinetic energy and relative velocity flows of air and water. It will allow air to pass through but water shall actually close the surge check, reducing the rate of water flow by means of throttling orifices in the plug to prevent shock closure of the Air/Vacuum Valve. The surge check orifices must be adjustable type to suite operating conditions in the field.

The inlet Isolation Butterfly Valve shall be DeZurik BOS wafer (compact) style, lever and variable position locking device, for special tools or skill. The seat must be Buna-N, molded with a steel flanged insert for high strength and tight seating. The disc must pivot eccentrically from closed position to clear center valve area.

The Air Release Valve shall be side connected to the upper valve, but separated with an Isolation Shut-Off Valve. The internal mechanism shall be the compound lever type to permit the valve to open under pressure to vent pockets of entrapped air as they accumulate. The compound mechanism shall be activated by a stainless steel concave float to lift the Buna-N needle to shut-off the Air Release orifice.

The Slow Closing Air/Vacuum Valve shall have been flow tested in the field, substantiated by test data to show reduction of surge pressure in the valve.

The Release Valve shall be model 1900 – Slow Closing Air & Vacuum Valve as manufactured by APCO Valve and Primer Corporation, Schaumburg, Illinois or GA Industries.

2.15 PRESSURE REDUCING VALVES:
A. The valve shall be a Singer Valve model 106 - PR-48, ANSI Class 150 (ANSI 300, ANSI flanges drilled to ISO PN 10 / 16 / 25 or 40) pressure rating/ flange standard, globe (angle), style valve. The Model 160 Pressure Reducing Pilot (Normally Open Pilot) spring range shall as specified by the Engineer.

1. The valve shall maintain accurate control of the downstream pressure regardless of fluctuation in flow or upstream pressure through main valve with the exception of low flow applications where a direct acting by-pass pressure-reducing valve will over ride the operation of the main valve.

2. Refer to "Main Valve" section, 106-PG for detailed information pertaining to valve sizes and materials, selection criteria and specifications.

3. Refer to "Pilot and Accessories" section, Model 160 Pressure Reducing Pilot (Normally Open Pilot) and Model 26 Flow Stabilizer for detailed information pertaining to materials and specifications. Consult factory for direct acting Low Flow By-Pass specification information.

4. Main Valve:
   a. Valve(s) shall be a hydraulically operated globe (angle) valve. The inner valve assembly shall be top and bottom guided by means of easily replaceable bearing bushings. The inner valve assembly shall be the only moving part and shall be securely mounted on a 316 stainless steel stem. The stainless steel stem shall be provided with wrench flats on all valves 1” (25mm) to 16” (400mm), for ease of assembly and maintenance.
   b. All pressure containing components shall be constructed of ASTM A536-65/45/12 ductile iron. The flanges shall be designed to ANSI Class 150 or Class 300 standards. Flange drilling to ANSI shall be standard however British, ISO and other drillings shall be available upon request.
   c. Valve(s) shall have a protective fusion bonded epoxy coating internally and externally. The protective fusion bonded epoxy coating shall conform to the ANSI/AWWA C116/A21.16 (current version) specification.
   d. Valve(s) 8” (200mm) and smaller shall provide smooth "frictionless" motion with actuation being achieved by the use of a SRD style EPDM diaphragm. They shall be constructed of nylon fabric bonded with synthetic rubber. The diaphragms shall not be used as a seating surface. No lip seals or packing may be used to seal the actuator.
   e. Valve(s) 6” (150mm) and larger shall provide smooth "frictionless" motion and maximum low flow stability with actuation being achieved by the use of the Singer rolling diaphragm technology. The diaphragms shall not be used as a seating surface. No lip seals
or packing may be used to seal the actuator.

f. The valve cover shall have a separate stem cap giving access to the stem for alignment check, spring installation and ease of assembly.

g. On valve(s) 1” (25mm) and larger, bonnets shall be accurately located to bodies utilizing locating pins. Locating pins shall eliminate corrosion resulting from the use of uncoated ductile iron to ductile iron surfaces.

h. Valve(s) 3” (80mm) and larger shall have the 316 stainless steel seat, bolted in place, utilizing "Spiralock" thread tapping technology. The 316 stainless steel seat ring shall be easily replaceable without special tools.

i. The valve(s) shall form a drip tight seal between the stationary stainless steel seat ring and the resilient disc, which has a rectangular cross-section and is retained by clamping on three and one half sides. The resilient disc shall be constructed of Buna or EPDM for normal service conditions.

j. All external fasteners shall be 18-8 stainless steel with 18-8 washers.

k. All repairs and maintenance shall be possible without removing the valve from the line. To facilitate easy removal and replacement of the inner valve assembly and to reduce unnecessary wear on the guide, the stem shall be vertical when the valve is mounted in a horizontal line.

l. Each valve shall be tested prior to shipment. The standard test shall include a pressure test and a full functional, operational test when pilots and accessories are fitted to suit a particular application.

m. The valve(s) shall be covered by a minimum three year (3) warranty against defects in materials and workmanship. The stainless steel seat ring shall be covered by a lifetime replacement warranty.

n. The valve shall be manufactured by Singer Valve

5. Pilots & Accessories:

a. The pilot shall be Singer Model 160, with the spring range specified.

b. The normally open pilot shall be of bronze construction with a spring to adjust the pressure setting.

c. The pilot seat, stem and inner valve shall be of stainless steel 316 constructions and the inner valve shall have EPDM resilient compound for seating. The EPDM compound must be bonded permanently to the inner valve and be ground flat and square to assure maximum performance.

d. The pilot guide stem shall be guided by a Delrin bushing in the spring casing above the diaphragm and totally removed from the flow of water in the main pilot chamber. The pilot guide and stem location above the diaphragm shall eliminate debris buildup and
sticking as well as minimize turbulence and false readings on the diaphragm.
e. The pilot shall be self-cleaning and self-flushing by locating the outlet in the bottom of the pilot ninety degrees to the inlet.
f. Maximum Working Temperature: 180 degree F (82 degree C)
g. Maximum Working Pressure: 400 psi (27.6 bar)

6. The flow stabilizer shall be a Singer Model 26 (sizes 8" 106, 10" 206 and smaller is included).
   a. The flow stabilizer body shall be of stainless steel construction.
   b. The flow stabilizer shall allow unrestricted flow into the main valve bonnet while offering adjustable restricted flow out of the bonnet.
   c. The flow stabilizer shall be self cleaning and resistant to plugging
   d. The Singer proprietary tapered internal orifice and inner valve shall offer precise adjustment, which shall be lockable by utilizing the top locknut.
   e. The flow stabilizer shall improve low flow stability when incorporated with other "Singer Low Flow" proprietary automatic control valve enhancements.
   f. Maximum Working Temperature: 180 degree F (82 degree C)
   g. Maximum Working Pressure: 400 psi (27.6 bar)
h. Connections: ¼" (6.35 mm) NPT

2.16 AIR PRESSURE REGULATION STATION:

A. Air receivers for the instrument air pressure regulation station shall be built to ASME standards and have a National Board certificate. One tank shall have a 100 gallon capacity, approximately 20-inch diameter x 75-inch, designed for vertical mounting. The second tank shall have a 40 gallon capacity, approximately 15 inch diameter x 54 inch, also designed for vertical mounting. Design pressure shall be 200 psig. Fittings shall include a manual ½-inch ball drain valve with fittings, inlets, outlet and all required taps for control piping. Provide a 3 ½ inch gauge with 200 psi pressure range, plus two gauge petcocks, one for the gauge and one for the inspector's test connection, and necessary fittings to install the gauge and petcocks. Provide all other fittings as shown on the drawings for pipe connections and drains. There shall also be an approved safety relief valve for each tank set for the tank working pressure plus necessary fittings to install it. The receivers shall incorporate mounting legs complying with applicable standards. Legs shall set the tank a minimum of 12 inches above the floor.
B. Air pressure regulators shall be diaphragm controlled, relieving type, made of non-corrosive materials and be equipped with a pressure gauge on the pressure regulated outlet of the regulator. Pressure regulators shall have a field adjustable regulated pressure range of 0 to 100 psig. The size of the regulators shall be as recommended by the supplier for a maximum air flow of 10 SCFM.

C. Filter-coalescer shall be capable of delivering clean, dry air to pneumatic equipment, sized to be installed in a one-inch line for a minimum flow of 10 SCFM. Filter shall be an Ingersoll Rand 810 series, Model No. 815 or approved equal.

2.17 SOLENOID VALVES:

A. Solenoid valves shall be normally open or closed as required. All solenoid valves shall include a manual override operator (MO). Valves shall be of brass body construction, resilient seating, general purpose service RED-HAT type as manufactured by Automatic Switch Company (ASCO), Florham, New Jersey, or equal.

B. Solenoid valves specified in subparagraph 1 above shall be suitable for operation on a 120 volt, 60 Hertz power supply unless otherwise shown on the Drawings and be provided with encapsulated, Class F insulation in a NEMA Type I enclosure with a conduit knockout.

C. All solenoid valves shall be installed with ball type bypass valves to permit operation in a manual mode where shown on drawings.

2.18 PRECAST CONCRETE MANHOLES

A. All buried valves shall be installed in precast concrete manholes. Valve box shall be. Manhole access covers shall have “WATER” cast into the top of all water lines, "SEWER" cast into the top for all wastewater lines and "DRAIN" cast into the top of all drain line. All valves shall have actuating nuts extended to within 6 inches of the top of the valve box adapter.
B. All buried valves shall be supplied with a valve nameplate with suitable anchors for casting in concrete. Nameplate shall be 3 inches in diameter bronze disk with raised lettering ⅛-inch high and manufactured by Shiedow Bronze Corporation, Kingwood, W. VA; or equal.

2.19 CORPORATION COCKS:

Corporation cocks for connections to cast-iron, ductile iron or steel piping shall be all brass or bronze suitable for 150 psi operating pressure and similar to Mueller Co. H-10046 or equal by Clow Corp., and shall be of sizes required and/or noted on the Drawings.

2.20 EXPANSION JOINTS:

A. Expansion joints shall be manufactured of molded neoprene with filled triple arches. Joints shall be reinforced with galvanized ⅜-inch split steel retaining rings placed directly against the inside of the flanged to prevent damage to the rubber surface when the bolts are tightened. Expansion joints shall be suitable for buried service or above ground service. Flanges shall be drilled to ANSI 125#. Working pressures as follows:

<table>
<thead>
<tr>
<th>Size</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;-4&quot;</td>
<td>165#</td>
</tr>
<tr>
<td>5&quot;-12&quot;</td>
<td>140#</td>
</tr>
<tr>
<td>14&quot;</td>
<td>85#</td>
</tr>
<tr>
<td>16&quot;-24&quot;</td>
<td>65#</td>
</tr>
<tr>
<td>26&quot;-66&quot;</td>
<td>55#</td>
</tr>
</tbody>
</table>

B. Maximum temperature shall be 180° F and shall be capable of a maximum 1½-inch lateral movement. Expansion joints shall be Model J-I as manufactured by the Red Valve Company, or engineer approved equal.

2.21 FLANGED ADAPTORS:

A. Flanged adaptors where shown on the Drawings shall be "Uni-Flange" as manufactured by Uni-Flange Corporation, Series 400.

B. Flange shall be ductile iron designed to meet the requirements of ANSI D16. Set screw shall be AISI 4140 steel, heat treated, zinc

C. Where shown on the Drawings adaptor shall be harnessed.

2.22 FLEXIBLE COUPLINGS:

A. Flexible couplings shall be either the split type or the sleeve Type as shown on The Drawings.
1. Split type coupling shall be used with all interior piping and with exterior piping as noted on the Drawings. The couplings shall be mechanical type for radius groove piping. The couplings shall mechanically engage and lock grooved pipe ends in a positive couple and allow for angular deflection and contraction and expansion.

2. Couplings shall consist of malleable iron, ASTM Specification A47, Grade 32510 housing clamps in two or more parts, a single chlorinated butyl composition sealing gasket with a "C" shaped cross-section and internal sealing lips projecting diagonally inward, and two or more oval track head type bolts with hexagonal heavy nuts conforming to ASTM Specification A183 and A194 to assemble the housing clamps. Bolts and nuts shall be hot dipped galvanized after fabrication.

3. Victaulic type couplings and fittings may be used in lieu of flanged joints. Pipes shall be radius grooved as specified for use with the Victaulic couplings. Flanged adapter connections at fittings, valves, and equipment shall be Victaulic Vic Flange Style 741, equal by Gustin-Bacon Group, Division of Certain-Teed Products, Kansas City, Kansas, or equal.

4. Sleeve type couplings shall be used where shown on the Drawings. The couplings shall be of steel and shall be Dresser Style 38, Smith Blair Style 413, Baker Allsteel, or equal. The coupling shall be provided with hot dipped galvanized steel bolts and nuts unless indicated otherwise.

5. All couplings shall be furnished with the pipe stop removed.

6. Couplings shall be provided with gaskets of a composition suitable or exposure to the liquid within the pipe.

7. If the Contractor decides to use victaulic couplings in lieu of flanged joints, he shall be responsible for supplying supports for the joints.

2.23 FLEXIBLE CONNECTORS:

Flexible connectors shall be constructed of bronze hose and braid with female copper tube sweat fittings brazed on each end. Connectors shall be Style BF as manufactured by Vibration Mountings and Controls, Inc., Butler, N.Y., equal by American, Waterbury, Conn., or equal.
2.24 STRAINERS:

Strainers shall be installed as shown on the Drawings and shall be of the duplex basket type. Strainers shall have bronze bodies with a removable bronze screen and stainless steel baskets. Strainers shall be of the type such that baskets can be emptied without taking the strainer offline. Strainers shall be rated for a minimum pressure of 150 psi. Strainers shall be manufactured by Hayward or equal.

2.25 ROTAMETER:

Rotameters shall generally be provided by the chemical equipment supply to be installed on the drawings. The meter sight tube shall be constructed of impact resistant glass with a cast bronze body. Maximum pressure loss shall be 50 inches of water. The rotameter shall be similar to Model 10A2235A - Rotosight Catalog Number 2235597 by Fischer & Porter, Warminster, Penna. or equal.

2.26 DIAPHRAM SEALS:

A. Diaphragm seals shall be installed on pressure gauge connection to all sludge, chemical and air lines where shown on the Drawings, to protect pressure switches used to monitor excessive pressures on sludge, chemical and air lines. The diaphragm shall be "thread attached" to both piping and pressure switches. Diaphragm seals shall be constructed of cadmium plated carbon steel, except for the lower housing which shall be specifically chosen according to the fluid pressure being monitored.

B. Diaphragm seals shall have a flushing connection and #. Type SB by Mansfield and Green; No. 877 Trerice; Marshalltown; or equal.

2.27 PRESSURE SWITCHES:

A. Pressure switches shall be suitable for mounting with diaphragm seals and installed when shown on the Drawings. Pressure switches shall be of watertight construction, with SPDT Contacts suitable for 120 volt service and ampere capacity, with external adjustment of pressure setting.

B. Pressure switches shall be suitable for the service intended and a pressure range as specified in the Instrument List in Section 13615.

C. The pressure switch shall be Allen-Bradley, United Electric, Mercoid, or equal.

2.28 UNIONS:

Unions on ferrous pipe 2 inches in diameter and smaller shall be 150 pounds
malleable iron, zinc-coated. Unions on water piping 2½ inches in diameter and larger shall be flange pattern, 125-pound class, zinc-coated. Gaskets for flanged unions shall be of the best quality fiber, plastic, or leather. Unions shall not be concealed in walls, ceilings, or partitions.

2.29 HOSE BIBBS:

Hose bibbs shall be brass, polished chromium plated, as manufactured by Chicago Faucet Company. Hose bibbs shall be No. 952, ¾-inch or 1 inch with vacuum breaker as noted on the Drawings.

2.30 PRESSURE GAUGES:

A. Each pressure gauge shall be direct mounted, polished stainless steel case with a 3½-inch diameter dial and furnished with an acrylic plastic window, ¼-inch shut-off valve, and be glycerin filled with bronze or stainless steel tube. All gauges shall be weatherproofed. The face dial shall be white finished aluminum with jet black graduations and figures. The face dial shall indicate the units of pressure being measured (e.g. feet, inches, etc.) or be dual scale. Socket material shall be bronze.

B. Pressure gauges shall be equal to Ashcroft Model 1009, or approved equal. Ranges shall be suitable to the application and will be as approved by the Engineer.

2.31 MUD VALVES:

A. The mud valves shall be of the non-rising stem type, with cast iron body and flanged ends. The stem, stem nut, stop collar, disc ring and seat ring shall be bronze. Bolts and nuts shall be stainless steel Type 316. Where shown on the Drawings, valves shall be equipped with Type 304 stainless steel extension stem and crank operated offset-type floor stand. The distance from the bottom face of the flange to the operator shall be as shown on the Drawings.

B. The mud valves shall be Model A25612RB as manufactured by Troy Valve, Model OS 5002 as manufactured by Rodney Hunt Company, Orange, Massachusetts, equal by Clow Corporation, or equal.

C. Stem guides shall be provided as required as recommended by the manufacturer to prevent damage to the valve or stem. Stem guides shall be cast iron, bronze bushed, mounted on cast iron brackets.

2.32 TELESCOPIC VALVES:

A. Telescoping valves shall be rising stem such as manufactured by Troy
Valve, Fountaine, or engineer approved equal. Each valve shall be supplied as a complete unit consisting of floorstand and electric motor operator, lift rod, bail, slip tube, companion flange with sealing gasket and mounting plate.

B. The floorstand shall be cast iron with base flange pre-drilled for anchoring to the mounting plate. The valve shall be operated by an electric motor operator to allow for remote operation. Electric motor operator to be Rotork Accumulators, Inc. or engineer approved equal.

C. The connecting bail shall be 304 stainless steel. The lift rod shall be 304 stainless steel. The bail shall be fastened to the lift rod with a stainless steel jam nut. The slip tube shall be 304 stainless steel with an outside diameter of 8 inches. The top discharge end shall have two (2) “V” notches 180 degrees apart for flow control. The length of the slip tube shall be sufficient to allow full required travel of four feet with enough pipe remaining below the companion flange to provide adequate support.

D. Each valve shall be furnished with a cast iron companion flange to match the 8 inch diameter standard ductile iron flange. Each companion flange shall be furnished with a sealing neoprene gasket to be replaced without removal of slip tube from riser pipe. Mating flange and bolt to be provided by the Contractor.

E. Valve to be supplied with a 3/8” thick stainless steel mounting plate and bracket. Plate is to be mounted to the top of thickener wall and design to support the complete valve and any necessary maintenance. All anchor bolts are to be stainless steel.

2.33 FLOOR TYPE PRESSURE RELIEF VALVES (SSTL):

Resilient Seat in Cover. Removable Stainless Steel Grate. Integrally Cast Water Stop Valves to be Supplied in Exact Required Length Valve body, lid and grate to be cast 304 Stainless Steel Extendable with PVC pipe to any length required

Valves shall be Troy Valve Model A2550RSN 304 or 316 SS, or approved equal

2.33 PIPE SLEEVE SEALS:

A watertight seal at all wall sleeves shall be obtained using expandable rubber seal rings as shown on the Drawings. These seal rings shall be the modular mechanical type consisting of synthetic rubber links shaped to continuously fill the annual space between the pipe and wall sleeve. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned
in the sleeve, tightening of the bolts shall cause the rubber sealing sleeve. The watertight seal shall be effective against a hydrostatic head of at least 40 feet. The seal shall also be constructed so as to provide electrical insulation between the pipe and wall, thus reducing chances of cathodic reaction between these two members.

2.34 BACKFLOW PREVENTERS:
Backflow preventers shall be of reduced pressure type with two (2) independently operating check valves and shall be designed to operate in a horizontal flow mode. An independent relief valve shall be located between the two (2) check valves. Preventers shall be as manufactured by Hersey Products, Inc., or equal.

2.35 PRESSURE SENSORS:
Pressure sensors shall be of the wafer type, designed to fit between standard pipe flanges. Sensor shall be flow through design with flexible elastomer sensing ring around the full circumference. Pressure sensing ring shall measure pressure for 360 degrees around the full inside circumference of the pipeline. Sensor shall be manufactures such that it can be interlocked with pumps. All sensors shall be Series 48 as manufactured by Red Valve Company or engineer approved equal.
PART 3 - EXECUTION

3.01 INSTALLATION:

A. All valves and appurtenances shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.

B. After installation, all valves and appurtenances shall be tested at least two (2) hours at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any point proves to be defective, it shall be repaired to the satisfaction of the Engineer.

C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direct bearing on their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.

D. Pipe for use with flexible couplings shall have plain ends as specified in the respective pipe sections in Division 15.

E. Flanged and mechanical joints under water or exposed to weather shall be made with type 304 stainless steel bolts, nuts and washers.

F. Prior to assembly of split couplings, the grooves as well as other parts shall be thoroughly cleaned. The ends of the pipes and outside of the gaskets shall be moderately coated with petroleum jelly, cup grease, soft soap or graphite paste, and the gasket shall be slipped over one pipe end. After the other pipe has been brought to the correct position, the gasket shall be centered properly over the pipe ends with the lips against the pipes. The housing sections then shall be placed. After the bolts have been inserted, the nuts shall be tightened until the housing sections are firmly in contact, metal-to-metal, without excessive bolt tension.

G. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8 inches. Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6 inches from the end, and the middle ring shall be placed on the already laid pipe end until it is properly centered over the joint. The other pipe end shall be inserted into the middle ring and brought to proper position in relation to the pipe already laid. The gaskets and followers shall then be pressed evenly and firmly into the middle ring flares. After the bolts have been inserted and all nuts have been made up fingertight, diametrically opposite nuts shall be
progressively and uniformly tightened all around the joint, preferably by use of a torque wrench of the appropriate size and torque for the bolts.

H. Pressure gauges shall not be installed until after the substantial completion date unless otherwise requested by the Owner.

I. Valve boxes with concrete bases shall be installed as shown on the Drawings. Mechanical joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Place cast iron box over each stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on cover shall be parallel to pipe. Remove any sand or undesirable fill from valve box.

3.02 SHOP PAINTING:

Ferrous surfaces of valves and appurtenances shall receive an exterior coating of rust-inhibitive primer as specified in Section 09900. Interior coatings shall be the manufacturer's standard except that valves on raw and potable water lines shall be coated with paints approved by both EPA and AWWA for potable water service. All pipe connection openings shall be capped after shop painting to prevent the entry of foreign matter prior to installation.

3.03 FIELD PAINTING:

All metal valves and appurtenances specified herein and exposed to view will be painted as part of the Work in Section 09900. All exposed pipe joints on pipe, valves and fittings shall be caulked 360 degrees prior to painting.

3.04 INSPECTION AND TESTING:

Completed pipe shall be subjected to hydrostatic pressure tests for four (4) hours at full working pressure. All leaks shall be repaired and lines retested as approved by the Engineer. Prior to testing, the gravity pipelines shall be supported in an approved manner to prevent movement during tests.

END OF SECTION 15996
SECTION 15999

PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Furnish all labor, materials, equipment and incidentals and install a complete system of pipe hangers, supports, concrete inserts and anchor bolts including all metallic hanging and supporting devices for supporting non-buried piping as shown on the Drawings and as specified herein.

B. The absence of pipe supports and details on the Drawings shall not relieve the Contractor of the responsibility for providing them. Pipe supports indicated on the Drawings are shown only to convey the intent of the design for a particular location and are not intended to represent a complete system.

1.02 RELATED WORK:

A. Concrete is included in Division 3.

B. Field painting is included in Division 9.

C. Pipe and fittings are included in respective sections of Divisions 13 and 15.

D. Valves and appurtenances are included in Section 15996.

1.03 SUBMITTALS:

A. Submit to the Engineer as provided in Section 15987 and 01500, complete sets of shop drawings of all items to be furnished under this Section. Submittals shall include complete layouts, schedules, location plans and complete total bill of materials for all pipe support systems.

B. Submittals shall include a representative catalog cut for each different type of pipe hanger or support indicating the materials of construction, important dimensions and range of pipe sizes for which that hanger is suitable. Where standard hangers and/or supports are not suitable, submit detailed drawings showing materials and details of construction for each type of special hanger and/or support.

C. Submittals shall include complete piping drawings as submitted for each piping submittal indicating type of hanger and/or support, location, magnitude of load transmitted to the structure and type of anchor, guide and other pipe supporting
appurtenances. Submittals shall use detail numbers as shown on the Drawings to indicate type of support proposed whenever possible.

D. Types and locations of pipe hangers and/or supports shall also be shown on the piping layouts for each piping submittal as specified in the respective Division 15 pipe specifications.

E. Submit complete design data for pipe support systems to show conformance with this Specification.

1.04 REFERENCE STANDARDS:

A. Manufacturer's Standardization Society (MSS):
   1. MSS SP-58 Pipe Hangers and Supports - Materials and Design.
   2. MSS SP-69 Pipe Hangers and Supports - Selection and Application.

B. American Society for Testing and Materials (ASTM):
   1. ASTM A36 Structural Steel.
   2. ASTM A307 Carbon Steel Externally and Internally Threaded Standard Fasteners.

C. American National Standards Institute (ANSI):
   1. ANSI B31 Power Piping.

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALIFICATIONS:

A. All hangers, supports and appurtenances shall conform to the latest applicable requirements of ANSI B31.1, except as supplemented or modified by the requirements of this Specification.

B. All hangers, supports and appurtenances shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for all supporting equipment, with the exception of springs, shall be five times the ultimate tensile strength of the material, assuming 10-feet of waterfilled pipe being supported.
C. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, submit certification stating that such requirements have been complied with.

1.06 DELIVERY AND STORAGE:

A. All supports and hangers shall be crated, delivered and uncrated so as to protect against any damage.

B. All parts shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed.

C. Finished metal surfaces not galvanized, that are not of stainless steel construction, or that are not coated, shall be grease coated, to prevent rust and corrosion.

PART 2 - PRODUCTS

2.01 GENERAL:

A. All of the equipment specified herein is intended to support the various types of pipe and piping systems. The details shown on the Drawings are intended to indicate the generally desired methods of support under normal conditions. It shall be the responsibility of the Contractor to develop final details and any details associated with special conditions not already covered to meet the system conditions specified in the respective Division 15 pipe specifications.

B. All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, fittings and other pipe appurtenances and to support and secure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact. Any structural steel members required to brace any piping from excessive dislocation shall conform to the applicable requirements of Section 05500 and shall be furnished and installed under this Section.

C. Hangers and supports shall be spaced in accordance with ANSI B31.1 except that the maximum unsupported span shall not exceed 10 feet unless otherwise specified herein.

D. Where flexible couplings are required at equipment, tanks, etc. the end opposite to the piece of equipment, tank, etc. shall be rigidly supported.
E. All pipe and appurtenances connected to the equipment shall be supported in a manner to prevent any strain from being imposed on the equipment or piping system.

F. All rods, clamps, hangers, inserts, anchor bolts, brackets, and components for interior pipe supports shall be furnished with galvanized finish, hot dipped or electro-galvanized coated, except where field welding is required. Interior clamps on plastic pipe shall be plastic coated. Supports for copper pipe shall be copper plated or shall have a 1/16-in plastic coating. All rods, clamps, hangers, inserts, anchor bolts, brackets, and components for submerged pipe, exterior pipe and pipe within outdoor structures shall be of Type 316 stainless steel.

G. All non-insulated non-metallic piping such as PVC, CPVC, etc. shall be protected from local stress concentrations at each support point. Support material shall be as defined in Part 2.1(F) of this Section. Where pipes are bottom supported 180 degrees, arc shields shall be furnished. Where 360 degree arc support is required, such as U bolts, protection shields shall be provided for the entire pipe circumference. Arc support material shall be as defined in Part 2.1(F) of this Section. Protection shields shall have an 18 gauge minimum thickness, not be less than 12-inches in length and be securely fastened to pipe with stainless steel or galvanized metal straps not less than ½-inch wide.

H. All insulated pipe shall be furnished with a rigid foam insulating saddle at each pipe support location as specified under respective pipe insulation. Provide protection shields as specified in Part 2.1(G) at each support location.

I. Supports shall be sufficiently close together such that the sag of the pipe is within limits that will permit drainage and avoid excessive bending stresses from concentrated loads between supports.

J. Where pipe hangers and supports come in contact with copper piping provide protection from galvanic corrosion or use copper plated or PVC coated hangers and supports.

K. Pipe supports shall be provided as follows:

1. Ductile iron piping shall be supported at a maximum support spacing of 10 feet with a minimum of one support per pipe section at the joints.

2. Steel and stainless steel piping 2½ inch or larger diameter shall be supported at a maximum support spacing of 10 feet with a minimum of one support per pipe section at the joints.

3. Support spacing for steel and stainless steel piping 2 inch and smaller diameter and copper tubing shall not exceed 5 feet.
4. PVC pipes shall be supported as recommended by the manufacturer except that in no case shall support-spacing exceed 5 feet.

5. All vertical pipes shall be supported at each floor or at intervals of not more than 12 feet by approved pipe collars, clamps, brackets, or wall rests and at all points necessary to insure rigid construction.

6. Pipe supports shall not induce point loadings but shall distribute pipe loads evenly along the pipe circumference.

7. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or as specified herein. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless specifically directed or authorized by the Engineer.

8. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings, and sleeve type couplings and to minimize all pipe forces on equipment housings. Equipment housings shall not be utilized to support connecting pipes.

9. Effects of thermal expansion and contraction of the pipe shall be accounted for in the pipe support selection and installation.

L. Unless otherwise specified herein, pipe hangers and supports shall be as manufactured by Grinnell Co., Inc., Providence, RI; Carpenter & Patterson, Inc., Woburn, MA; Unistrut Corp., Klayne, MI; Chalfant Mfg. Co., Cleveland, OH; Metals Products Div.; U.S. Gypsum, Chicago, IL, or equal. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary. Any item comparable in type, style, quality, design and performance shall be considered as equal.

M. Any required pipe supports for which the supports specified in this Section are not applicable shall be fabricated or constructed from standard structural steel shapes, concrete and anchor hardware similar to items previously specified herein and shall be subject to the approval of the Engineer.

N. Expansion anchors shall be equal to Kwik-Bolt as manufactured by the McCullock Industries, Minneapolis, MI or Wej-it manufactured by Wej-it Expansion Products, Inc., Bloomfield, CO. The length of expansion bolts shall be sufficient to place the wedge portion of the bolt a minimum of 1 inch behind the steel reinforcement.

O. Hanger rods shall be hot rolled steel, machine threaded and galvanized after fabrication for interior applications and stainless steel for all exterior applications.
The strength of the rod shall be based on its root diameter. Hanger rods shall be attached to concrete structures using concrete inserts similar to F&S Figures 180, 571 or 150; or continuous concrete inserts per F&S. Inserts shall be malleable iron, or steel with galvanized finish or stainless steel. Beam clamps, C clamps or welded beam attachments shall be used for attaching hanger rods to structural steel members. Where necessary and approved by the Engineer, expansion anchors shall be used for attaching to concrete structures.

P. All uninsulated non-metallic piping such as PVC, CPVC, etc shall be protected from local stress concentrations at each support point. Protection shall be provided by galvanized steel protection shields or other method as approved by the Engineer for interior applications and stainless steel shields for exterior applications. Where pipes are bottom supported 180 degrees, arc shields shall be furnished. Where 360 degree arc support is required, such as U bolts, protection shields shall be provided for the entire pipe circumference. Protection shields shall have an 18 gauge minimum thickness, not be less than 12-inch in length and be securely fastened to pipe with stainless steel or galvanized metal straps not less than ½-inch wide.

2.02 SINGLE PIPE HANGERS:

A. Single pipes shall be supported by hangers suspended by galvanized steel rods from structural steel members, concrete ceilings, beams, and wall mounted steel angle brackets.

B. Hanger rods shall be hot rolled steel, machine threaded and galvanized after fabrication. The strength of the rod shall be based on its root diameter.

C. Except as otherwise specified herein, pipe hangers shall be steel, of the adjustable clevis type similar to Grinnell Figure Numbers 65,260 and 590 as required. Hangers shall be carbon steel with a galvanized finish.

D. Hangers for individual PVC pipes shall be Grinnel Figure 97C rated hangers.

E. Hanger rods shall be attached to concrete structures using individual concrete inserts similar to Grinnel Figure No. 282 or continuous inserts similar to Carpenter and Patterson Figure 1480. Inserts shall be malleable iron, C clamps or welded beam attachments shall be used for attaching hanger rods to structural steel members. Where necessary and approved by the Engineer, double expansion shields shall be used for attaching to concrete structures.

2.03 MULTIPLE PIPE HANGERS:

A. Suspended multiple pipes, running parallel in the same horizontal plane, which are adjacent to each other shall be suspended by trapeze type hangers or wall brackets. Trapeze hangers shall consist of galvanized structural steel channel...
supported from galvanized threaded rod or attached to concrete walls, columns or structural steel support members as required to meet the intent of this specification. Channel shall be similar to Carpenter and Patterson Figure 371. Rods, concrete inserts, "C" Clamps, beam clamps, and welded beam attachments shall be as specified in Paragraph 2.02 Single Pipe Hangers above.

B. Except as otherwise specified herein pipe anchors used for attaching pipe to trapeze or multiple pipe wall brackets shall be anchor or pipe chairs similar to Carpenter and Patterson Figure 127. Material of construction shall be galvanized steel. Chair "U" bolts shall be tightened to allow freedom of movement for normal expansion and contraction except where pipe must be anchored to control direction of movement or act as a thrust anchor.

C. Non-submerged multiple PVC pipes shall be supported by supports fabricated from 1⅝-inch steel metal framing equal to Unistrut Figure P1000. Channels, supports, wall brackets and other accessories shall be sized and constructed in accordance with the manufacturer's recommendations. Channels and parts shall be furnished with rust inhibiting acrylic enamel paint. Pipe clamps, nuts, bolts and washers shall be stainless steel.

D. Submerged PVC piping (either individual pipes or multiple piping) shall be supported by Type 316 stainless steel, 1⅝-inch channel framing and secured with non-metallic or 316 stainless steel pipe clamps. Accessory parts shall be Type 316 stainless steel.

2.04 SINGLE AND MULTIPLE PIPE SUPPORTS:

A. Single pipes located in a horizontal plane close to the floor shall be supported by one of the methods specified herein or as shown on the Drawings.

B. Pipes 3 inches in diameter and larger shall be supported by adjustable stanchions similar to Carpenter and Patterson Figure 101, constructed of galvanized steel for interior applications and stainless steel for exterior applications. Stanchions shall provide at least 4-inches adjustment and be flange mounted to floor.

C. Pipes less than 3 inches in diameter shall be held in position by supports fabricated from steel metal framing equal to Unistrut Figure P1000, welded post base similar to Unistrut Figure P2072A and pipe clamps similar to Unistrut Figures P1109SS thru P1119SS. Where required to assure adequate support, fabricate supports using two (2) vertical members and post bases connected together by horizontal member of sufficient load capacity to support pipe. Wherever possible supports shall be fastened to nearby walls or other structural member to provide horizontal rigidity. More than one pipe may be supported from a common fabricated support. All supports unless specified elsewhere shall be furnished with rust inhibiting acrylic enamel paint.
D. Where shown on the Drawings, pipe shall be supported using concrete piers, cradles or posts. Pipe shall be securely fastened to the concrete using suitable metal straps as required and as approved by the Engineer.

2.05 WALL SUPPORTED PIPES:

A. Single or multiple pipes located adjacent to walls, columns or other structural members, whenever deemed necessary, shall be supported using welded steel wall brackets similar to Carpenter and Patterson Figure numbers 69-78, 84, or 139; or metal framing type steel brackets and pipe clamps. All members shall be securely fastened to wall, column, etc. using double expansion shields or other method as approved by the Engineer. Additional wall bearing plates shall be provided where required.

B. Pipe shall be attached to supports using methods hereinbefore specified to meet the intent of this Specification.

C. All supports shall be galvanized, except that metal framing shall be furnished with enamel finish.

2.06 BASE ANCHOR SUPPORT:

A. Where pipes change direction from horizontal to vertical via a bend, a welded or cast base anchor support shall be installed at the bend to carry the load. The bend anchor shall be fastened to the floor, with double expansion shields or other method as approved by the Engineer.

B. Where shown on the Drawings, pipe bends shall be supported using concrete anchor posts. Pipes shall be securely fastened to the concrete supports with suitable metal bands as required and approved by the Engineer.

2.07 VERTICAL PIPE SUPPORTS:

A. Where vertical pipes are not supported by a Unistrut system, they shall be supported in one of the following methods.

1. For pipes ¼-inches to 2-inches in diameter, an extension hanger ring shall be provided with an extension rod and hanger flange. The rod diameter shall be as recommended by the manufacturer for the type of pipe to be supported. The hanger ring shall be galvanized steel or PVC clad depending on the supported pipe. The hanger ring shall be equal to Carpenter & Paterson Fig. No. 81 or 81CT. The anchor flange shall be galvanized malleable iron similar to Carpenter and Patterson Figure No. 85.
2. For pipes equal to or greater than ½-inches in diameter offset pipe clamps similar to Carpenter and Patterson Figure No. 179 may be used. The hanger shall be attached to concrete structures using double expansion shields.

3. Pipe riser clamps shall be used to support all vertical pipes extending through floor slabs. Riser clamps shall be galvanized steel similar to Carpenter and Patterson Figure No. 126. Copper clad, Carpenter and Patterson Figure 126CT or PVC coated clamps shall be used on copper pipes. Insulation shall be removed from insulated pipes prior to installing riser clamps.

4. Unless otherwise specified, shown, or specifically approved by the Engineer, vertical runs exceeding 12 feet shall be supported by approved pipe collars, clamps, brackets or wall vests at all points required to ensure a rigid installation.

2.08 TRAY SUPPORT:

A. Hose and PVC piping may be supported continuously by ladder type aluminum tray. Trays shall be 12-inch minimum width by 4-inch nominal depth with 6-inch rung spacing. Trays shall have aluminum drip shield to prevent leakage onto flooring. Trays shall be sloped towards drains where risers shall pipe any chemical leakage to drain. Trays shall be furnished complete with aluminum fittings, plates, wall brackets, hangers, clips, rods, etc. for a complete system and to ensure that the trays are rigidly supported in accordance with the manufacturer's recommendations. Fitting shall have a 3 foot minimum turning radius. Pipe shall be secured to the rungs with plastic ties. Trays shall be as manufactured by Chalfant, Husky-Burndy of Metal Products Division of United States Gypsum.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. All pipes, horizontal and vertical, requiring rigid support shall be supported from the building structure by approved methods. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or specified herein. No piping shall be supported from metal stairs, ladders and walkways unless specifically directed or authorized by the Engineer.

B. All pipe supports shall be designed with liberal strength and stiffness to support the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement and pressure forces,
thermal expansion and contraction, vibrations and all probable externally applied forces. Prior to installation, all pipe supports shall be approved by the Engineer.

C. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings and sleeve type couplings, and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.

D. Inserts for pipe hangers and supports shall be installed on forms before concrete is placed. Before setting these items, all Drawings and figures shall be checked which have a direct bearing on the pipe location. Responsibility for the proper location of pipe supports is included under this Section.

E. Continuous metal inserts shall be embedded flush with the concrete surface.

F. Hose and pipe shall be installed neatly in trays. Minimum turning radius shall be three feet. Pipe and hose shall lay flat on bottom of tray and shall be secured in place.

3.02 TESTING:

A. All pipe support systems shall be tested for compliance with the Specifications. After installation, each pipe support system shall be tested in conjunction with the respective piping pressure tests. If any part of the pipe support system proves to be defective or inadequate, it shall be repaired or augmented under this Section to the satisfaction of the Engineer.

END OF SECTION
SECTION 16400 - ELECTRICAL

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Provide a complete electrical system as indicated on the Drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:
   1. Branch circuit breakers in existing panelboards.
   2. Feeder system, in conduit.
   3. Branch circuit wiring, in conduit, for lighting, receptacles, junction boxes and motors.
   4. Hangers, anchors, sleeves, chases, supports for fixtures, and other electrical materials and equipment in association therewith.
   5. Lighting fixtures and lamps.
   6. Wiring system, in conduit, for equipment and controls provided under other Sections of these Specifications including, but not necessarily limited to, Equipment and Mechanical Sections.
   7. Motor starters and controls for motors provided under the Contract, but for which motor starters and controls are not otherwise provided.
   8. Other items and services required to complete the systems whether particularly mentioned or not.

B. Related work:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>A</td>
<td>Ampere (Amps)</td>
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<tr>
<td>AFF</td>
<td>Above Finished Floor</td>
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<tr>
<td>AFG</td>
<td>Above Finished Grade</td>
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<tr>
<td>AHJ</td>
<td>Local Authority Having Jurisdiction</td>
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<tr>
<td>AIC</td>
<td>Amps Interrupting Current</td>
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<tr>
<td>AFCI</td>
<td>Arc-Fault Circuit Interrupter</td>
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<tr>
<td>ANSI</td>
<td>The American National Standards Institute</td>
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<tr>
<td>BF</td>
<td>Ballast Factor</td>
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<tr>
<td>Bkr.</td>
<td>Breaker</td>
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<tr>
<td>C</td>
<td>Conduit</td>
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<td>Ckt.</td>
<td>Circuit</td>
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<td>CRI</td>
<td>Color Rendering Index</td>
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<tr>
<td>CU</td>
<td>Copper Conductor</td>
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<tr>
<td>DETD</td>
<td>Dual Element Time Delay Fuse</td>
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<tr>
<td>Disc.</td>
<td>Disconnect</td>
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<tr>
<td>Dn</td>
<td>Down</td>
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<tr>
<td>EMT</td>
<td>Electrical Metallic Tubing</td>
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<tr>
<td>FLA</td>
<td>Full Load Amps</td>
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<tr>
<td>FPM</td>
<td>Fuse per Manufacturer Requirements</td>
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<tr>
<td>FS</td>
<td>Federal Specifications</td>
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<tr>
<td>G or Gnd.</td>
<td>Ground</td>
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<tr>
<td>GFCI</td>
<td>Ground-Fault Circuit Interrupter</td>
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<tr>
<td>GFP</td>
<td>Ground-Fault Protection</td>
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<tr>
<td>MCA</td>
<td>Minimum Circuit Amps</td>
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<td>MCC</td>
<td>Motor Control Center</td>
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<td>MCM</td>
<td>1000 Circular Mils (KCMIL)</td>
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<tr>
<td>MOCP</td>
<td>Maximum Over-current Protection</td>
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<tr>
<td>N</td>
<td>Neutral</td>
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<tr>
<td>NEC</td>
<td>2011 National Electrical Code</td>
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<tr>
<td>NEMA</td>
<td>National Electrical Manufacturers Association</td>
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<td>NFPA</td>
<td>National Fire Protection Association</td>
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<tr>
<td>NIC</td>
<td>Not in Contract</td>
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<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Act</td>
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<tr>
<td>PF</td>
<td>Power Factor</td>
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<tr>
<td>PLC</td>
<td>Programmable Logic Controller</td>
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<tr>
<td>PVC</td>
<td>Polyvinyl Chloride Conduit</td>
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<tr>
<td>RGSC</td>
<td>Rigid Galvanized Steel Conduit</td>
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<tr>
<td>RMS</td>
<td>Root Mean Square</td>
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<tr>
<td>RTU</td>
<td>Remote Terminal Unit</td>
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<tr>
<td>SCADA</td>
<td>Supervisory Control and Data Acquisition</td>
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<tr>
<td>SCCR</td>
<td>Short-Circuit Current Rating</td>
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<tr>
<td>SPD</td>
<td>Surge Suppression Device</td>
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<tr>
<td>Sym</td>
<td>Symmetrical</td>
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<tr>
<td>THD</td>
<td>Total Harmonic Distortion</td>
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<tr>
<td>TSP</td>
<td>Twisted Shielded Pair</td>
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<tr>
<td>TST</td>
<td>Twisted Shielded Triplet</td>
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</table>
1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section. These shall include, but not be limited to, an electrical supervisor who is a licensed master electrician, a field foreman with a minimum journeyman electrician’s license and adequate electricians and helpers.

B. Without additional cost to the Owner, provide such other labor and materials required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. Electrical subcontractor shall furnish a 100 percent performance bond and a 100 percent payment bond to the Contractor as security for the faithful performance of this Section, as security for the payment of all persons performing labor on the project under this Section and furnishing materials in connection with this Section. The performance bond and payment bond shall be in separate instruments.

1.4 SUBMITTALS

A. Comply with pertinent provisions of Section 01340.

B. Product data: Within 30 calendar days after the Contractor has received the Owner’s Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section.
2. Manufacturer’s specifications, other data and shop drawings needed to prove compliance with the specified requirements. Provide the following approval drawings:

   a. Wiring devices and cover plates.
   b. Conduit and fittings.
   c. Conductors.
   d. Connectors.
   e. Lighting fixtures.
   f. Lamps and Ballasts.
   g. Safety/Disconnect switches.
   h. Special systems.

3. Manufacturer’s recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
C. Samples:
1. When so requested by the Engineer.
2. When specifically, so requested by the Contractor and approved by the Engineer, approved samples will be returned to the Contractor for installation on the Work.

D. Manual: Upon completion of this portion of the Work and as a condition of its acceptance, provide operation and maintenance manuals in accordance with the provisions of these Specifications. Include within each manual:
1. Copy of the approved Record Documents for this portion of the Work.
2. Copies of all circuit directories.
3. Copies of all warranties and guaranties.

1.5 PRODUCT HANDLING
A. Comply with pertinent provisions of these Specifications.

1.6 WARRANTY
A. Provide standard one (1) year warranty on all labor and materials.
B. Provide a ten (10) year warranty on all LED lighting fixtures.
C. Comply with these Specifications.

1.7 RULES AND PERMITS
A. The entire installation shall be in accordance with the latest edition of the NEC, OSHA, and all local codes.
B. Apply and pay for all permits and inspections required by local or state laws.
C. Furnish the Owner with certificate of inspection and final approval from all authorities having jurisdiction.
D. Installers of PVC Coated Conduit shall be certified and be able to present a valid, unexpired installer certification card prior to installation taking place.

1.8 DRAWINGS
A. The drawings and specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. The drawings are diagrammatic and are to be followed as closely as the construction will permit.
B. The drawings show the general location of outlets, conduits and circuit arrangement. Because of the small scale of the drawings, it is not possible to indicate all of the detail involved. The Contractor shall carefully investigate the structural and finish conditions affecting all his Work and shall arrange such work accordingly, furnishing such fittings, junction boxes and accessories as may be required to meet such conditions.

1.9 ELECTRICAL SERVICE
A. The electrical service is existing.

1.10 ELECTRICAL OUTAGE
A. Coordinate all outages with the Owner, 72 hours prior. Schedule all outages such that they will not interfere with normal plant operation and that there will be no delays in equipment startup and placing the facilities in operation.

1.11 SPARE PARTS
A. Provide the following spare parts to Owner in neatly packaged box marked with contents:

1. Keys: One (1) set of spare panelboard/switchboard keys with lists to Owner.
2. Fuses: One (1) box fuses for each type and size installed on the project.

PART 2 – PRODUCTS

2.1 GENERAL
A. Provide only materials that are new, of the type and quality specified. Where Underwriters’ Laboratories, Inc. have established standards for such materials, provide only materials bearing the UL label. Materials called for are to be considered as standard that, however, implies no right on the part of the Contractor to substitute other materials and methods without written authority from the Engineer.

B. Temporary power:

1. In addition to providing temporary power as described in Section 01500 of these Specifications, provide and pay the costs for installing permanent electrical meter or meters.
2. When all equipment is in place and connected, and the Engineer determines the project is ready for final checkout, arrange to have the permanent metering installed in the Owner’s name. At this point, the Owner will be responsible for all charges.

C. Where any material or operation is specified by reference to published specifications or standards or the specifications or standards of any other organization; the referenced specification or standard shall be as much a part of this Section as if quoted in full herein.

2.2 RACEWAYS
A. Applicable Standards:

1. ANSI C80.1: Rigid Steel Conduits, Zinc-Coated.
2. ANSI C80.3: Electrical Metallic Tubing, Zinc Coated.
3. ANSI C80.5: Rigid Aluminum Conduits.
4. ANSI C80.6: Intermediate Metallic Conduits.
5. ANSI/NEMA FB1: Fittings and Supports for Conduit and Cable Assemblies.
6. UL 6: Rigid Steel Conduit – Zinc Coated.
7. UL 651-2002: Schedule 40 PVC and schedule 80 Rigid PVC Conduit.
8. UL 514B: Flexible conduit fittings.
10. NEMA FB 1: Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable.

B. Acceptable Manufacturers:
1. Wheatland.
2. Allied Tube.
3. Perma-Cote; Division of Robroy.
4. Ocal.
5. Plasti-Bond
6. Carlon.
7. KorKap

C. Provide conduit and fittings conforming to the above standards.

D. Rigid galvanized steel conduit and fittings – types:
1. Provide threaded type fittings and form 8 conduit bodies with material to match conduit.
   Provide PVC coated fittings for PVC coated rigid galvanized steel conduit installations.
2. Provide rigid galvanized steel conduit with external 40-mil PVC coating and internal, 2-mil urethane surface.
3. Provide seal fittings for rigid galvanized steel conduit where indicated on the plans equal to Crouse-Hinds series EYSX. Provide PVC coated seal fittings for PVC coated rigid galvanized steel conduit installations.
4. Provide sealing compound and fiber by Crouse-Hinds or approved equal:
   a. Sealing Compound: Chico A.
   b. Sealing Fiber: Chico X.
5. Provide USA manufactured base materials for PVC coated fittings, hangers, straps, etc.

E. Provide compression type fittings and conduit bodies with matching material for electrical metallic tubing conduit.

F. Rigid aluminum conduit:
1. Provide threaded type fittings and form 8 conduit bodies with material to match conduit.
2. Provide seal fittings for rigid aluminum conduit where indicated on the plans equal to Crouse-Hinds series EYSX. Provide sealing compound and fiber by Crouse-Hinds or approved equal:
   c. Sealing Compound: Chico A.
   d. Sealing Fiber: Chico X.
3. Provide thread type fittings and conduit bodies with matching material.
4. Provide standard aluminum electric conduit couplings
   a. Do not use pipe couplings or sleeves.
5. Provide aluminum fittings.
6. Do not imbed aluminum conduit concrete containing chlorides, unwashed beach sand, sea water, or coral bearing aggregates without PVC coating, heat shrink or two coats of bitumastic.
7. Use strap wrenches for tightening aluminum conduit.
   a. Do not use Pipe wrenches, channel locks, chain wrenches, pliers, etc.
8. Clean and coat all threads on aluminum conduit and fittings with “No-Oxide” compound before using.
9. Completely cover Aluminum conduit installed in concrete or below grade with two(2) coats of bitumastic paint or PVC coating.
10. Terminate aluminum conduit entering manholes and below grade pullboxes with grounding type bushings and connected to a 3/4” x 10” copper clad rod with a #6 bare copper wire.
11. All risers from underground, concrete pads, floors, etc.
a. Provide heat shrink tubing (Raychem or equal) from a point 12 inches below bottom of slab or grade to a point not less than 6 inches above grade or surface of slab.

G. Provide aluminum flexible conduit for flexible installations.

H. Conduit/Cable supports – properties:
   1. Provide 316 stainless steel supports for all exposed metallic conduit as manufactured by Unistrut or approved equal.
   2. Provide fiberglass supports for all exposed non-metallic conduit/cable as manufactured by Aickinustrut or approved equal.
   3. Provide one-hole, PVC coated, malleable iron conduit straps with back spacer for all PVC coated rigid galvanized steel conduit.
   4. Provide PVC coated beam clamps with uncoated 316 stainless steel nuts and bolts for all PVC coated rigid galvanized steel conduit.
   5. Provide stainless steel strain relief and cable grips/supports for power cables. Tie each support of to the hanger support.

I. All conduits to conform to the following specifications:
   1. Installations under concrete slab: Schedule 40 PVC
   2. Exposed outdoor locations: Rigid aluminum conduit.
   4. Concealed Interior Locations: Schedule 40 PVC.
   5. Installations in concrete-encased duct banks: Schedule 40 PVC.
   6. Installations underground exposed to earth: Rigid aluminum conduit with PVC or other coating.
   7. Rigid aluminum conduit shall be used at all locations (underground and within structures) as raceways for shielded process instrumentation wiring, shielded control wiring, data highway wiring and I/O wiring.

2.3 CONDUCTORS

A. Applicable standards:
   1. NEMA WC 3: Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
   2. NEMA WC 5: Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

B. Conductors Acceptable Manufacturers:
   1. Okonite.
   2. Pirelli.
   4. Superior Essex.
   5. Belden.

C. Connectors Acceptable Manufacturers:
   1. ILSCO
   2. Polaris

D. Conductor types:
   1. Low voltage conductors (0 to 600V):
      a. For secondary service entrance, feeders, underground, under floor, in damp or wet locations, and to any process associated equipment provide copper, 600V, 90°C, Type XHHW.
      b. For all other low voltage conductors, provide copper, 600V, 75°C, Type THWN.
      c. Provide stranded conductors for sizes #12 and larger.
d. Provide same type of equipment grounding conductors as specified above.

e. Provide all branch circuit wiring installed within ballast compartment of light fixtures rated 90°C, Type THHN.

f. Analog Control/Communications (TSP or TST) – Provide tinned copper, polyethylene insulated, twisted pair or triplet, aluminum-polyester, overall shield with 20-gauge drain.

g. Provide analog signal conductors sized as shown on drawings with minimum size of 18-gauge.

h. For all discrete signal conductors, provide copper stranded, 600V, Type THWN with a minimum size of #14, unless otherwise noted.

i. For all control conductors installed in underground conduits provide cable listed as suitable for direct burial.

2. Splices, Connections and Terminations (0 to 600V):

   a. For #8 AWG, use solderless pressure connectors with insulating covers for copper wire splices and taps. Use insulated spring wire connectors with plastic caps for #10 AWG and smaller.

   b. Use insulated, mechanical connectors for copper wire splices and taps, #6AWG and larger. Tape connectors with electrical tape to prevent moisture infiltration.

   c. Where connections are located in manholes or handholes use insulated submersible type.

2.4 GROUNDING AND BONDING

A. Applicable standards:


B. Grounding electrodes (Rod type):

   1. Acceptable Manufacturers:
      a. LTV Copperweld.
      b. Line Material.
   3. Diameter: 3/4".
   4. Length: 10'-0"
   5. Type: Sectional.

C. Mechanical connectors:

   1. Acceptable Manufacturers:
      a. Burndy.
      b. Robbins.
      c. Harger.

D. Exothermically-welded connections:

   1. Acceptable Manufacturers:
      a. Cadweld.

E. Grounding Electrode Conductor:

   1. Material: Bare, soft-drawn, stranded, copper.
   2. Minimum size: Meet NFPA 70 requirements.

F. Bonding Material:
1. Material: Bare, soft-drawn, stranded, copper.
2. Minimum size: Meet NFPA 70 requirements.

G. Regulatory requirements:
1. Products: Listed and classified by UL as suitable for the purpose specified and indicated.

H. Ground Access Wells:
1. Provide 12”x12”x12” polymer concrete ground access well where indicated on plans.
2. Provide engraved cover with “ground” indicator.
3. Rated for a minimum of 20,000 lbs.
4. Provide Harger GAW series or approved equal.

2.5 OUTLET BOXES

A. Applicable standards:
1. ANSI/NEMA OS 1: Sheet-steel Outlet Boxes, Device Boxes, Covers and Box Supports.
2. ANSI/NEMA OS 2: Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
3. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).
4. NEMA FB 1: Type FD, Cast Ferroalloy Boxes.

B. Types and properties:

1. Outlet boxes:
   a. Sheet metal outlet boxes (ANSI/NEMA OS1; galvanized steel, with 1/2" male fixture studs where required).
   b. Nonmetallic outlet boxes (ANSI/NEMA OS2).
   c. Cast aluminum boxes where exposed. (NEMA FB1; deep type, gasketed cover, threaded hubs).

C. Pull and junction boxes:

1. Sheet metal boxes:
   a. Indoor location installations:
      1) Provide the type specified in ANSI/NEMA OS1, NEMA 12 painted steel unless stated otherwise on drawings in non-process areas. Provide NEMA 4X stainless steel for process areas.
      2) Provide hinged-type enclosure for enclosures larger than 12 inches in any dimension.
      3) Provide hinged-type enclosure for enclosures larger than 12 inches in any dimension.
   b. Outdoor location installations: Provide NEMA 4X 316 stainless steel.

2. Cast aluminum boxes:
   a. Outdoor and wet location installations: Conform to NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as rain tight, aluminum box cover with ground flange, neoprene gasket, and stainless steel cover screws as manufactured by Cooper Crouse-Hinds.
   b. Non-metallic boxes:
      a. In Ground location installations: Conform to UL 508, NEMA type as shown on drawings, pre-cast polymer concrete, with removable, heavy-duty bolted cover, and stainless steel cover screws as manufactured by Strongwell.

D. Box locations:

1. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
   a. Electrical box locations shown on Contract Drawings are approximate unless dimensioned.
   b. Verify the location of all boxes and outlets prior to rough in.
c. Locate the boxes to allow access.
d. Locate and install boxes such that headroom is maintained and a neat appearance is presented.

2.6 HANDHOLES

A. Applicable standards:

3. ASTM C478-03a” Standard Specification for Pre-cast Reinforced Concrete Manhole Sections.
4. ASTM A615: Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

B. Handholes:

1. Provide handholes a minimum size of 24” x 36” x 24” and larger sizes as required by per NEC.
2. Provide non-traffic rated enclosures where installed out of roadway with heavy-duty cover tested to a minimum of 20,000 PSI, having a minimum coefficient of friction of 0.50. Provide cover engraved with “Electric”.
3. Provide non-traffic rated enclosures equal to Quazite PG series with HA type cover or Engineer approved equal.
4. Provide traffic rated enclosures with knockouts as indicated on plans and cover tested to a minimum of 32,000 psi. Provide cover engraved with “Electric”.
5. Provide traffic rated enclosures equal to Fibercrete FHR series or Engineer approved equal.
6. Provide enclosures with divider, pulling eyes, cable racks and extension sleeves as applicable.
7. Provide enclosures equal to Quazite PG series with HA type cover.

2.7 WIRING DEVICES

A. Applicable standards:

1. FS W-C-596: Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
2. FS W-S-896: Switch, Toggle.
3. NEMA WD 1: General Purpose Wiring Devices.
4. NEMA WD 2: Semiconductor Dimmers for Incandescent Lamps.
5. NEMA WD 5: Specific Purpose Wiring Devices.

B. Acceptable Manufacturers:

1. Hubbell.
2. Pass and Seymour.
4. TayMac.
5. Lutron.

C. Wall Switches:

1. Provide wall switches for lighting circuits and motor loads under 1/2 HP conforming to NEMA WD; FS W-S-896; AC-general use snap switch with toggle handle, rated 20 amperes and 120-277VAC.
2. Provide switch with gray handle.
3. For exterior applications, provide cast box and weatherproof actuating lever toggle switch cover.

D. Receptacles:
   1. Provide convenience and straight-blade receptacles conforming to NEMA WD 1, locking blade receptacles conforming to NEMA WD 5, and convenience receptacle configuration conforming to NEMA WD 1; Type 5-20, gray plastic face.
   2. Provide specific-use receptacle configuration conforming to NEMA WD 1 type as indicated on the drawings, and with a brown plastic face.
   3. Provide GFCI duplex convenience receptacles with integral ground fault current interrupters and gray plastic face.

E. Wall Plates:
   1. Provide type 304 stainless steel oversized (jumbo) interior wall plates.
   2. Provide continuous-use rated exterior device cover. Provide cover constructed entirely of UV stabilized high impact polycarbonate material with gasket, stainless steel mounting screws and UL listed for wet location continuous-use. Provide cover equal to TayMac Specification Grade series.
   3. Design plates to fit the device or devices on which they are used.

2.8 LIGHTING

A. Applicable standards:
   1. FS W-F-414: Fixture, Lighting.
   2. ANSI C82.5: Specification for HID Ballasts.
   3. ANSI C82.1: Specification for Fluorescent Lamp Ballasts.

B. Interior luminaires and accessories are as shown on the Drawings.

C. Exterior luminaires and accessories:
   1. As shown on the Drawings.
   2. Enclosures: Complete with gaskets to form weatherproof assembly.

2.9 DISCONNECT/SAFETY SWITCHES

A. Applicable standards:
   1. ANSI/UL 198C: High intensity capacity fuses; current limiting types.
   2. ANSI/UL 198E: Class R fuses.
   3. FS W-F-870: Fuse holders (for plug and enclosed cartridge fuses).
   4. FS W-S-865: Switch, box (enclosed), surface-mounted.
   5. NEMA KS 1: Enclosed switches.

B. Acceptable manufacturers – disconnect/safety switches:
   1. General Electric.
   2. Square D.

C. Disconnect/Safety Switches:
   1. Fusible (safety) switch assemblies: NEMA KS 1; type HD, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position.
      a. Provide override screw to permit opening front cover with switch in ON position.
      b. Provide the handle lockable in OFF position.
      c. Provide fuse clips designed to accommodate Class R fuses.
      d. Provide enclosure types as indicated on Drawings.
2. Non-fusible (disconnect) switch assemblies: NEMA KS 1; type HD; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position.
   a. Provide override screw to permit opening front cover with switch in ON position.
   b. Provide the handle lockable in OFF position.
   c. Provide enclosure types as indicated on Drawings.

D. Fuses:
   1. Fuses 600 Amperes and Less: Current limiting type.
   2. Fuse Interrupting Rating: 200,000 RMS symmetrical amperes.

E. Acceptable manufacturers - fuses:
   2. Bussman.

F. Provide NEMA 4X 316 stainless steel in all interior process area and exterior installations. Provide NEMA 12 (stainless steel) in all other installations.

2.10 CONCRETE SUPPORT FOUNDATIONS

A. Install each freestanding unit of electrical equipment on a 4” thick, 3000 PSI wire mesh reinforced concrete pad or curb with 36” clear on front side and 12” clear on all remaining sides, unless otherwise noted on drawings. Provide ¾” chamfer all sides.

2.11 MISCELLANEOUS MATERIALS

A. Provide support framing, channel and associated accessories of aluminum conforming to the Drawings other sections of these specifications, except in areas containing chemicals, whereby fiberglass reinforced plastic only shall be utilized.

B. Provide and install equipment racks for panels as shown on the drawings and as described in the specifications, with the following as a minimum:
   1. Provide cross members consisting of two (2) horizontal pieces of pre-drilled 1-1/2” x 1-1/2” mounting channel, manufactured by Kindorff.
   2. Attach all struts with spring-loaded nuts and associated hardware provided by manufacturer of strut, and specifically designed for this purpose.
   3. Use 316 stainless steel stud nuts, manufactured by Kindorff.
   4. Support the mounting channel “cross bars” vertically by C-channels, 3” x 2” x 8’.
   5. Mount channels a maximum of 24” apart, center-to-center, quantity as required to accommodate equipment.
   6. Provide a foundation buried 36” underground and secured with 3000 PSI concrete pad, sized as shown on plans with a minimum of 36” clear walking space in front of control panels and 12” on sides and rear of panel.
   7. Provide ¾” chamfer on all concrete edges.

C. Provide 316 stainless steel (bolts, nuts, washers, U-bolts, anchors, threaded rods, etc.) attachment hardware.

2.12 LABELING

A. Mark all 480-volt equipment with red laminated plastic nameplates having one-half inch (1/2”) engraved lettering, reading “DANGER 480-VOLTS”. Attach plate to equipment with stainless steel screws.

B. Mark conductors within panelboards with self-sticking label bearing the number corresponding to the circuit number on the drawings. Connect these conductors to corresponding breaker in panel. Mark circuit numbers in outlet boxes only where color-coding is repeated by having two or more conductors of the same color.

C. Mark equipment, switchboards, panelboards, cabinets, transformers, control devices, starters, switches, etc.
D. Labels shall be created by means of black phenolic material having engraved Micarta letters with white core having ¼" engraved lettering.

E. Provide designations as indicated on the drawings to include:
   1. Name of the equipment or equipment that is being served,
   2. Power source and circuit of origin along with room location
   3. Voltage and number of phases.

F. Attach plates to equipment with stainless steel screws.

G. Mark all junction boxes with the voltages contained internal to it. If multiple power sources are internal to the junction boxes, it shall be labelled “Contains Multiple Power Sources”

H. Panelboards shall contain typed and laminated panel schedules indicating circuit numbers and loads

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Coordination:
   1. Coordinate as necessary with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.
   2. Coordinate the installation of electrical items with the schedule for work of other trades to prevent unnecessary delays in the total Work.
   3. Where lighting fixtures and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports and wiring to clear the encroachment.

B. Data indicated on the Drawings and in these Specifications are as exact as could be secured, but their absolute accuracy is not warranted. The exact locations, distances, levels, and other conditions will be governed by actual construction and the Drawings and Specifications should be used only for guidance in such regard.

C. Where outlets are not specifically located on the Drawings, locate as determined in the field by the Engineer. Where outlets are installed without such specific direction, relocate as directed by the Engineer and at no additional cost to the Owner.

D. Verify all measurements at the building. No extra compensation will be allowed because of differences between work shown on the Drawings and actual measurements at the site of construction.

E. Branch circuit wiring and arrangement of home runs have been designed for maximum economy consistent with adequate sizing for voltage drops and other considerations. Install the wiring with circuits arranged exactly as shown on the Drawings, except as otherwise approved in advance by the Engineer.

3.3 ELECTRICAL SERVICE

A. Verify location of utility transformer pad and install per utility company specifications, providing all materials and labor required for a complete installation. Verify location of utility company secondary delivery point and report any discrepancies to the Engineer immediately.

3.4 TRENCHING AND BACKFILLING
A. Perform trenching and backfilling associated with the work of this Section in strict accordance with the provisions of Section 02221 of these Specifications.

3.5 CONDUCTORS

A. Install no conductor smaller than #12 AWG unless otherwise indicated.
B. Provide copper conductors.
C. Provide conductors as shown on the plans or as specified herein.
D. Provide continuous wiring from outlet to outlet, identified by color and marked with size, grade and manufacturer.
E. Provide continuous wiring without joints, through pull boxes.
F. Provide minimum of #10 AWG conductors on branch circuits, which exceed 100’ at 120 volts and 200’ at 277 volts from panel to load center.
G. Terminate #14 AWG stranded conductors where indicated for control, using insulated compression-type spade lugs.
H. Terminate #12 AWG stranded conductors using insulated compression-type spade lugs.
I. Install an equal number of conductors for each phase of a circuit in the same raceway or cable.
J. The conductor lengths for parallel circuits must be made equal.
K. Neatly train and lace all wiring inside boxes, equipment, and panel boards.
L. Connect circuits sharing a common neutral to different phases regardless of the numbering.
M. Provide phase, neutral, and ground conductors as required to accommodate metering installed. Any additional conductors required for meter to function properly shall be installed at the Contractor’s expense.
N. Megger testing of medium voltage cable per UL 1072.

3.6 COLOR CODE AND MARKERS

A. Provide color-coding for #12 and #10 conductors as follows:

<table>
<thead>
<tr>
<th></th>
<th>277/480-Volt</th>
<th>120/208(240)-Volt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase “A”</td>
<td>Brown</td>
<td>Black</td>
</tr>
<tr>
<td>Phase “B”</td>
<td>Orange</td>
<td>Red</td>
</tr>
<tr>
<td>Phase “C”</td>
<td>Yellow</td>
<td>Blue</td>
</tr>
<tr>
<td>Neutral</td>
<td>White with Tracer</td>
<td>White</td>
</tr>
<tr>
<td>Ground</td>
<td>Green</td>
<td>Green</td>
</tr>
</tbody>
</table>

B. Mark all conductors #8 and larger and all feeders with plastic tape to match the above color-coding.
C. Provide primary cables with phase code as directed by the Engineer.

3.7 SPLICES, CONNECTIONS, AND TERMINATIONS IN 600V. CONDUCTORS

A. Provide final connections and/or terminations for all wiring indicated on the electrical drawings and in this division of the specifications. Equipment supplied under other divisions of the specifications that require electrical connections under this division shall be provided with Engineer approved wiring and termination diagrams.
B. Splice only in accessible junction boxes.
C. Thoroughly clean wires before installing lugs and connectors.
D. Terminate spare conductors with electrical tape.

3.8 RACEWAYS AND FITTINGS

A. When PVC coated conduit systems are utilized, the raceway manufacturer prior to installation shall certify the Contractor. Submit certification to the Engineer in writing.
B. When PVC coated conduit systems are utilized, provide inspection and certification of the complete raceway installation in writing by an authorized representative of the PVC coated materials supplier.
   1. During the construction process, at regular intervals, and prior to any raceway being covered, the representative shall inspect the system until it is confirmed that it meets the manufacturer’s intended requirements.
   2. Remove and reinstall any portion of the conduit installation that does not meet the intended installation methods at no additional cost to the Owner.
C. Provide certification to insure that all PVC overlapping connections, conduit threading, thread coating, sealing, etc., has been performed in accordance with manufacturer’s recommended procedures.
D. Apply thread compound to all field-cut threads prior to installation.
E. In general, follow the raceway installation layout shown on the plans, however, this layout is diagrammatic only, and where changes are necessary due to structural conditions, other apparatus or other causes, make such changes without any additional cost to the Owner.
F. Cut all conduits square using a saw or pipe cutter and de-burr cut ends.
G. Install the conduit to the shoulder of fittings and couplings and fastened securely.
H. Use conduit hubs, or sealing locknuts, for fastening conduit to cast boxes and for fastening conduit to sheet metal boxes in damp or wet locations.
I. No more than the equivalent of three 90-degree bends may be installed between boxes.
J. Use conduit bodies to make sharp changes in direction, as around beams.
K. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2” size.
L. Avoid Moisture traps where possible; where moisture traps are unavoidable, there must be a junction box with drain fitting provided at the conduit low point. Use suitable conduit caps to protect installed conduit against entrance of dirt, concrete, plaster, mortar, and moisture.
M. Size all conduits for conductor type installed with ¾” being the minimum size conduit allowed.
N. Arrange conduit to maintain headroom and present a neat appearance.
O. Route any exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
P. Provide at all times a minimum of 6” clearance between conduit and piping and a 12” clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.
Q. Arrange all conduit supports to prevent distortion of alignment by conductor pulling operations.
R. Fasten conduits above finished ceilings using straps, lay-in adjustable hangers, clevis hangers or bolted split stamped hangers.
1. Do not fasten conduit with wire or perforated pipe straps. All wire that was used for temporary conduit support during construction must be removed before conductors are pulled.
2. All conduits must be supported at a maximum distance of 5’ on centers.

S. Group conduits in parallel runs where practical using a conduit rack.

T. Make all underground conduit joints watertight by applying manufacturer’s recommended thread compound. Thread compound must be conductive and be compatible with conduit and conductor-jacket material.

U. Provide suitable pull string or #12 AWG insulated conductor in empty conduit, except sleeves and nipples.

V. Maintain minimum 12” clearance between all conduits containing signal circuits and conduits containing power circuits.

W. Install expansion-deflection joints where conduit crosses building expansion or seismic joints.

X. Where conduit penetrates fire-rated walls and floors, the opening around the conduit must be sealed with UL listed foamed silicone elastomer compound.

Y. Install exposed raceways either parallel or perpendicular to building walls.

Z. Install raceways exposed on walls or free standing perpendicular to the floor.

AA. Install exposed raceways on channel so as to provide a minimum spacing of 1/2” between raceway and the surface to which it is mounted.

BB. Bends:
   1. Where emerging from walls, ceilings, floor or concrete slabs, all conduit bends shall be made entirely within the structure (i.e.: the conduit shall emerge perpendicular to the surface and the bend shall be covered).
   2. Make all 90-degree conduit turns with factory-bent, rigid galvanized steel, long radius elbows.
   3. Utilize rigid aluminum, long radius elbows on all 90 degree conduit bends of 2” and larger.

CC. Install no metal conduit in contact with the earth or concrete slab unless protected with PVC coating or two coats of bitumastic coating.

DD. Provide necessary sleeves and chases where conduits pass through floors and walls, and provide other necessary openings and spaces, arranging for in proper time to prevent unnecessary cutting in connection with the Work.

EE. Perform cutting and patching in accordance with the provisions for the original Work.

FF. Refer to Section 02221 for minimum cover of underground conduits.

GG. Sealing Conduit:
   1. Install watertight conduit hubs on all conduits terminating in the top or sides of NEMA 3R, 4 or 4X enclosures.
   2. Use a sealing locknut having an integral gasket on conduits terminating in the bottom of NEMA 3R, 4 or 4X enclosures.
   3. Seal all conduits terminating in NEMA 3R, 4 or 4X enclosures with duct seal.
   4. Seal watertight all conduits terminating in NEMA 6 or watertight rated enclosures.
   5. Install sealing compound and fiber, per manufacturer’s recommendation, in hazardous location conduit sealing fittings. Tighten plugs per manufacturer’s recommended torque.

HH. Make motor lead connections and connections to other electrical equipment subject to vibration, or where indicated with flexible weatherproof type steel core conduit with wrapping and cover, factory assembled.
II. Conduit installations in hazardous locations as defined by Article 500 of the NEC must conform to the special requirements of Articles 501, 502, and 503 of the NEC.

JJ. Chapter 9 of the NEC shall apply unless larger raceways are specified.

KK. Ensure all threads are fully installed into fittings, boxes, enclosures and equipment per NEC and UL listing requirements to provide mechanical integrity, grounding and sealing. Provide fittings and adapters to ensure full length of conduit or conduit fitting threads are installed per code and listing requirements.

LL. Liquidtight flexible metal conduit shall be supported and securely fastened within 12 inches of each box, cabinet, conduit body or other conduit body termination and shall be supported and secured at intervals not to exceed 4-1/2 feet. Flexible metal conduit shall not exceed 6 feet in length except for luminaire connections as allowed per the NEC.

MM. Provide plastic threaded type bushings for all conduits terminated in enclosures.

3.9 CONDUIT SUPPORTS

A. Seal all ends of non-metallic conduit support with manufacturer’s recommended sealer.

B. Provide UL listed vinyl end caps for all ends of strut-type metallic conduit supports.

C. Provide all miscellaneous materials and supports as required by the NEC and these specifications to provide support for conduits, raceways, boxes, fittings and equipment.

3.10 GROUNDING AND BONDING

A. Ground and bond the electrical system and motors in accordance with Article 250 of the NEC.

B. Install electric bond around panels, cabinets, pull boxes, enclosures, etc., to incoming and outgoing sub-feed raceways by use of grounding type bushings.

C. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.

D. Provide grounding electrode conductor(s) and connect as shown on drawings.

E. Bond together metal siding not attached to grounded structure; bond to ground.

F. Provide separate, insulated, green equipment grounding conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

G. Provide grounding type bushings for conduits 1” or larger and bond to ground bar or lug of enclosure.

H. Bond neutral and ground at service entrance only.

I. Provide exothermic-type weld grounding connections that are buried or otherwise normally inaccessible, and excepting specifically those connections for which access is required for periodic testing.

J. Make each grounding connection strictly in accordance with the manufacturer’s written instructions. Failure to follow manufacturer's written instructions shall result in immediate rejection.

K. Welds which have "puffed up" or which show convex surfaces, indicating improper cleaning, are not acceptable. Provide grounding connection devices compatible with the conductor(s) and/or rods being joined.

L. Maximum acceptable resistance to earth ground is 25 Ohms. Provide testing of the service entrance system ground and verify the resistance to earth ground is within the specified requirements. If the existing service entrance ground does not meet the specified requirements, install additional rod electrodes as required to achieve specified resistance to ground.
M. Interface with lightning protection system where applicable.

3.11 OUTLET BOXES

A. Do not install boxes back-to-back in walls. Install the boxes at a minimum of 6” apart except in acoustic-rated walls with a minimum separation of 12”.
B. Locate boxes in masonry walls such that only the cutting of the masonry unit corner is required. Coordinate masonry cutting such that neat openings for the boxes can be achieved.
C. Provide knockout closures for unused openings.
D. Support boxes independently of the conduits.
E. Use multiple gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
F. Install boxes in the walls without damaging wall insulation.
G. Install outlets to locate luminaires as shown on plans.
H. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness.
I. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
J. Align wall mounted outlet boxes for switches, thermostats, and similar devices.
K. Provide cast outlet boxes in locations (exposed to the weather) and indoor wet locations.
L. Size all boxes in strict accordance with Article No. 370 of the NEC, except that no box will be less than the minimum specified.
M. Check the location of all outlets to see that the outlets will clear any new or existing wall fixture, shelving, work tables, sinks, bulletin boards, etc. and the outlet will fit the area intended.
N. Set floor boxes level and flush with finish flooring material. Use cast iron floor boxes for installations in slab on grade.
O. Locate pull and junction boxes above accessible ceilings or in unfinished areas. Support pull and junction boxes independently of conduit.
P. Install underground boxes as shown on drawings with top of box approximately 2” above finished grade. Install bottom of box over 12” of gravel to allow for adequate drainage.

3.12 CONVENIENCE OUTLETS AND SWITCHES

A. Install wall switches at 48” above the floor level and 6” from edge of door jam on strike side, unless otherwise noted on Drawings.
B. Install wall switches with the OFF position down.
C. Install convenience receptacles at 18” above the floor level or 6” above counter or backsplash.
D. Install convenience receptacles with the grounding pole on top.
E. Install all specific-use receptacles at heights shown on Contract Drawings.
F. Install decorative plates on switch, receptacle, and blank outlets in finished areas using jumbo size plates for outlets installed in masonry walls.

16400-17
G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

H. Install devices and wall plates flush and level.

3.13 LIGHTING FIXTURES

A. Install lamps in luminaires and lamp holders.

B. Support surface-mounted luminaires; provide auxiliary support, laid across top of ceiling TS, fasten to T using bolts, screws, rivets, or approved ceiling framing member clips.

C. Install fluorescent luminaires larger than 2’x4’ size independent of ceiling framing.

D. Install recessed luminaires to permit removal from below. Install grid clips. Support luminaires independently with 12-gauge minimum, galvanized, soft-annealed, mild steel wire.

E. Replace all non-operational lamps at completion of work.

F. Touch up luminaire and pole finish at completion of work with manufacturer's color- respective touch up kit.

G. Securely ground all lighting fixture housings.

H. Align luminaires and clean lenses and diffusers at completion of work.

I. Clean excess paint, dirt, and debris from installed luminaires.

3.14 POWER EQUIPMENT

A. Provide power and control wiring for motor starters and safety switches as shown on the Drawings.

B. Connections to miscellaneous building equipment:
   1. Wire to, and connect to, all items of building equipment not specifically described but to which electrical power is required.
   2. Coordinate as necessary with other trades and suppliers to verify types, numbers, and locations of equipment.

3.15 MOUNTING OF CONTROL PANELS AND ELECTRICAL EQUIPMENT

A. Install all equipment per the manufacturer’s recommendations and the contract drawings.

B. Install surface-mounted panelboards plumb, in conformance with NEMA PB 1.1.

C. Install disconnect switches with centerline at 48” above finished floor, grade, etc. unless otherwise noted.

D. Secure switchboard assemblies to foundation or floor channels.

E. Secure disconnect switches to channel frames with spring-type fasteners and hardware intended for this specific use where wall mounted, unless otherwise indicated.

F. Mount floor and wall mounted equipment utilizing Type 316 stainless steel anchors and fasteners of the size and number recommended by the manufacturer.

G. Provide necessary hardware to secure the assembly in place.

H. Provide 316 stainless steel fasteners for all other installation types.

I. Inspect switchboards and panel boards for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.
J. Install and check all equipment in accordance with the manufacturer’s recommendations.
K. Ensure that equipment mounting pad locations are level to within 0.125 inches per three foot of distance in any direction. Notify Engineer immediately if any discrepancies are found in the field.
L. Ensure that all equipment bus bars are torqued to the manufacturer’s recommendations.
M. Assemble all equipment shipping sections, remove all shipping braces and connect all shipping split mechanical and electrical connections.
N. Provide filler plates for unused spaces in panelboards and switchboards.
O. Provide typed circuit directory with protective plastic sleeve secured to inside of panel door for each branch circuit panelboard.
P. Provide Micarta type labels located adjacent to each breaker operator, delineating equipment served for each circuit breaker in all switchboards.
Q. Measure steady state load currents at each switchboard and panelboard feeder. Should the voltage difference measured at the equipment between any two phases exceed 20 percent, rearrange circuits to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
R. Measure and recording Megger readings phase-to-phase, phase-to-ground, and neutral-to-ground (four wire systems only).

3.16 HEATING, VENTILATING AND AIR CONDITIONING
A. Provide all power wiring for the plumbing, heating, ventilating and A.C. systems as shown on the drawings and according to an approved wiring diagram furnished by the Mechanical Contractor.
B. Control and interlock wiring shall be provided under other sections of these specifications, including conduit and outlet boxes required, except as specifically indicated on electrical drawings.
C. Make all connections to equipment required for proper operation.
D. Consult the mechanical drawings in detail for exact locations of all equipment.

3.17 TESTING AND INSPECTION
A. Provide personnel and equipment, make required tests, and secure required approvals from the Engineer and governmental agencies having jurisdiction.
B. Provide written notice to the Engineer adequately in advance of each of the following stages of construction:
   1. In the underground condition prior to placing concrete floor slab, when all associated electrical work is in place.
   2. When all rough-in is complete, but not covered.
   3. At completion of the work of this Section.
C. When material and/or workmanship are found to not comply with the specified requirements, replace items within three days after receipt of notice at no additional cost to the Owner.
D. Provide a qualified field serviceman, representing the manufacturer of each piece of major electrical equipment, to make proper and complete adjustments of all adjustable devices, load switches, etc. after final installation and completion of all field wiring. Verify and approve all connections prior to any initial or test operation of equipment. Submit confirmation in writing by the manufacturer’s authorized representative of said services to the Engineer.

3.18 HAZARDOUS LOCATIONS
A. Wiring and equipment in hazardous locations, as defined by the NEC, shall conform to the special requirements of the NEC, unless otherwise indicated or specified.

3.19 CLEANING AND PAINTING
A. Collect and remove from the premises all debris, scraps and other waste material after completion of work.
B. Tamp and level all trench work.
C. Remove excess dirt and debris, when and as directed by the Engineer.
D. Thoroughly clean all electrical equipment, lighting fixtures, exposed conduit, enclosures and boxes of all foreign materials and paint in accordance with Section 09900 of these Specifications unless noted or directed otherwise.
E. Clean any exposed threaded area of raceway of cutting oil and paint with a cold galvanizing compound prior to final finish painting.

3.20 ELECTRIC EQUIPMENT BY OTHERS
A. The equipment manufacturer shall furnish all motors for equipment.
B. Verify voltage, dimensions, extent, type, etc. of this and all other such electrical equipment.
C. Furnish and install all electrical supply and control equipment and material required to put all the items in proper operative condition.
D. Refer to other sections of these specifications for verification of other equipment and devices requiring electrical connections, wiring and devices not included in this section.
E. Refer to other drawings for details not indicated on the electrical drawings.
F. Prior to connecting any piece of such equipment, check the nameplate data against the information shown on the drawings and call to the immediate attention of the Engineer any discrepancies discovered.

3.21 PROJECT COMPLETION
A. Test all 600-Volt service entrance and feeder wiring using an instrument, which applies a voltage of approximately 500 volts DC to provide a direct reading of resistance.
B. Perform test on ground system utilizing Fall-Of-Potential method. Meg grounding systems to measure ground resistance, and provide not more than 25 ohms resistance, adding ground rods as necessary to achieve that level.
C. Conduct all tests in presence of Engineer or his representative. Identify and properly record all readings. Submit readings to Engineer for acceptance.
D. Measure voltages as directed by the Engineer and report to him these values.
E. Provide entire system free from all shorts and grounds.
F. Fully comply with local and national codes for equipment bonding and grounding.
G. Test system in the presence of the Engineer and operate to his complete satisfaction in accordance with true intent of plans and specifications. Defray cost of all adjustments necessary to bring system up to standards set forth by Contract Documents at no additional cost.
H. Thoroughly indoctrinate the Owner’s operation and maintenance personnel in the contents of the operations and maintenance manual.
I. On the first day the facility is in operation, for at least eight (8) hours at a time directed by the Engineer, provide a qualified foreman and crew to perform such electrical work as may be required by the Engineer.
3.22 FIELD SETTINGS
A. Perform field adjustments of the protective devices, as required, to place the equipment in final operating condition.

3.23 MEASUREMENT AND PAYMENT
A. No separate measurement or direct payment will be made for this work and all costs for same shall be included in the price bid for the work to which it pertains.

END OF SECTION
SECTION 11333 - SEPTAGE ACCEPTANCE PLANT

NORTH CHARLESTON, SOUTH CAROLINA

PART 1 - GENERAL

1.01 SUMMARY

A. The CONTRACTOR shall furnish, install and place into satisfactory operating condition the number of Septage Acceptance Plants as noted in paragraph 1.03.C.1. complete with 3-plane cylindrical bar screen for removing floating, particulate, or fibrous material from septage as shown on the Drawings and described in the Specifications.

1.02 REFERENCES

A. American Gear Manufacturers Association (AGMA)
B. American Institute of Steel Construction (AISC)
C. American Society of Testing and Materials (ASTM)
D. American Welding Society (AWS)
E. National Electrical Manufacturers Association (NEMA)
F. Steel Structures Painting Council (SSPC)

1.03 SYSTEM DESCRIPTION

A. Each unit shall consist of a 3-plane cylindrical bar screen complete with screen basket, rotating rake, cleaning comb, concentric screw conveyor, dewatering screw, screenings press with drive unit and pre-engineered housing complete with gasketed covers, tank vent, tank spray wash system, quick coupling inlet, inlet flow control valve, outlet connection, external rock trap, screenings bagging attachment, weather protection system, and liquid level sensing system. The unit shall be complete with electrical controls that include a main control panel, magnetic flow meter, security access system, (data management and accounting system) to provide a fully functional septage preliminary treatment system.

B. Systems for this project, other than 3-plane cylindrical bar screens with rotating rake with teeth that penetrate the full depth of the three-plane bar screen will not be considered for this project.

C. Design Summary
1. Number of Septage Acceptance Plants-----------------------------1
2. Maximum Screen Septage Hydraulic Capacity, gal/min --------- 500 (at 4% solids)
3. Maximum Screen Clean Water Hydraulic Capacity, gal/min... 3,329
4. Maximum Upstream Liquid Level, inches.......................... 19.00
5. Maximum Clean Water Headloss, inches ......................... 11
6. Bar Spacing, inches ...................................................... 1/4
7. Nominal Screening Basket Diameter, inches ....................... 40
8. Maximum Allowable Cleaning Cycle Time, seconds ............. 9
9. Nominal Screw Conveyor Diameter, inches ....................... 10
10. Minimum Screen Invert to Discharge Height, inches ............ 91
11. Speed Reducer Minimum Service Factor .......................... 1.63
12. Speed Reducer Minimum Torque Rating, in.-lb .................. 26,900
13. Speed Reducer Minimum Thrust Rating, lbf ...................... 8,400
14. Drive Motor Size, hp .................................................... 2
16. Motor and Solenoid Valve Electrical Classification ........... Non-Hazardous
17. Maximum Spray Wash System Flow Rate, gal/min .............. 20
18. Minimum Spray Wash System Pressure, psig .................... 60
19. Lower Wash System Number of Nozzles .......................... 9
20. Minimum Tank Width, feet ........................................... 4.08
21. Minimum Tank Length, feet .......................................... 7.25
22. Minimum Tank Height, feet ........................................... 4.83
23. Inlet Pipe Size, inches ................................................ 6
24. Inlet Piping Height Above Grade, feet ............................ 2.83
25. Outlet Pipe Size, inches .............................................. 8
26. Electrical Enclosure Type ............................................ NEMA 4X stainless steel

1.04 PRE-QUALIFICATION

A. All equipment manufacturers not listed in the specifications shall submit at least 15 days prior to the advertised date for receipt of bids a “Qualification Package” for the substitute or “or equal” equipment which the manufacturer proposes to furnish in lieu of products identified in the Contract Documents. The Bidder shall submit the Qualification Package under separate cover. Each Qualification Package shall be bound with protective cover, identify the specification section number and title, and the product manufacturer’s name on a cover sheet. The manufacturer shall submit the Qualification Package in a sealed sturdy box or suitable container. This section outlines the procedures for proposal of substitute or “or equal” items by “Alternate” manufacturers.

B. The use of this pre-qualification requirement is intended to protect the OWNER and Bidders so that no one Bidder gains an unfair bid price advantage by quoting a lower price for a screen that does not comply with the minimum performance and salient features set for by Section 11333.

C. The “Qualification Package” for the substitute or “or equal” equipment item of products the manufacturer proposes to furnish shall include but not be limited to, the following information as defined in 1.04.D.

D. The Qualification Package submittal requirements for the equipment shall be as follows:

1. The quality assurances set forth in Section 11333-1.10. for the substitute or “or equal” equipment item.
2. A complete set of drawings, specifications, catalogue cut-sheets, and detailed descriptive material of proposed equipment items or products. This information shall identify all technical and performance requirements stipulated on each drawing and in each specification section.

3. Detailed vendor information shall be submitted for all buy-out items such as hardware, motors, bearings, reducers, belts, sheaves, motor controllers and instrumentation (field device, major control panel device, and anticipated control panel layout).

4. List showing materials of construction of all components, including all buy-out items.

5. Certification that the stainless steel passivation process specified in paragraph 2.14.B. does not produce any hazardous waste byproducts.

6. Certification that the specified machining noted in paragraph 2.15.F. of all mating surfaces is part of the manufacturing process for the specified screen.

7. Certification that the drive speed reducer manufacturer is a member of AGMA and that the torque and thrust rating are in accordance with AGMA standards at the output speed of the reducer.

8. AWS welding inspector certifications in accordance with paragraph 2.15.G.

9. Manufacturer’s recommended spare parts, including all buy-out items.

10. Information on equipment field erection requirements including weight of assembled components and weight of each sub-assembly.

11. A maintenance schedule showing the required maintenance, frequency of maintenance, lubricants and other items required at each regular preventative maintenance period, including all buy-out items.

12. Process equipment electrical requirements and schematic diagrams

13. Provide a copy of this specification with a check next to each item to which the proposed equipment meets the specified standard. Where the proposed equipment does not strictly meet the requirements of this specification, provide information on the proposed exception to the specification that would bring the proposed, equipment into compliance with the requirements of this section.

14. Confirmation that the manufacturer has regularly engaged in the manufacturing and production of septage preliminary treatment equipment using a 3-plane cylindrical bar screen in the United States for a minimum of five (5) years. No equipment will be supplied by any manufacturer with less than five years experience.

The manufacturer must have installed and had in satisfactory use in this application a minimum of thirty (30) installations of identical type (septage acceptance plant 3-plane cylindrical bar screen) and size (31-inch diameter and larger) units as noted in paragraph 1.03.C.7. Provide a list of thirty (30) U.S. installations of similar type equipment comparable to the units specified.
The term “installations” shall mean individual projects/contracts. Multiple equipment units for a project will be considered as one (1) installation toward meeting the experience requirements. Installations shall be only those in the United States (fifty states). The installation shall include, but not be limited to, the following:

a. Name and location of installation.
b. Name of person in direct responsible charge for the equipment.
c. Address and phone number of person in direct responsible charge.
d. Month and year the equipment was placed in operation.
e. Brief description of equipment
f. Provide the name, address, and phone number of the contact person at the company that will provide service (both warranty period and post-warranty period) for the unit to the owner.

Bids from manufacturers lacking the U.S. experience requirements, but meeting all technical and performance requirements of the Contract Documents, can be considered if the manufacturer provides a satisfactory two (2) year maintenance bond in lieu of evidence of experience and operation. Maintenance bond shall be for 150 percent of the replacement value of the equipment. The bonding company shall have a policy-holder rating of A+ and a financial rating of "Class XV" in the most recent edition of "Best Key Rating Guide". The bonding company shall be licensed to do business in the State of South Carolina.

15. Hydraulic performance curves showing the relationship of headloss versus the full range of downstream liquid depths for the maximum clean water hydraulic capacity noted in paragraph 1.03.C.3., 67% of the flow noted in paragraph 1.03.C.3. and 33% of the flow noted in paragraph 1.03.C.3. Curves based upon other manufacturer's data will not be acceptable for this project.

16. Data from three (3) separate tests proving compliance of the screen with the "Paint Filter Test" as described in EPA Publication SW-846 Method 9095B.

E. Submittal Review Deposit, in the form of a certified bank check in the amount of $2,000 made payable to the OWNER. This deposit will be used for Engineer’s review of substitute equipment. The Engineer’s review time will be deducted at a rate of $150.00 per hour for reviewing substitution requests, regardless of whether the substitution is approved or rejected. The OWNER will return any unused funds to the petitioner within 30 days of the bid date.

F. If the Bidder fails to furnish all of the preceding information which has been deemed necessary by the Engineer to evaluate a proposed substitute or “or equal” equipment, the proposed substitute or “or equal” qualification package will be rejected by the Engineer.

G. The Engineer shall be the sole authority for determining conformance of a proposed substitute or “or equal” equipment item or product with the minimum requirements of the Contract Documents. Under no circumstances will the Engineer be required to prove that an “Alternate” major equipment item or product is not equal to the specified equipment item or product.

H. Failure to furnish the preceding information shall be cause for rejection of a proposed substitute or “or equal” equipment item or product for use on this project.

1.05 PERFORMANCE
A. The Septage Acceptance Plant shall automatically screen tankered septic tank sludges. Screenings shall be washed, transported, compressed and dewatered by a single mechanism. The complete removal procedure shall be encased to reduce odors.

B. The 3-plane cylindrical bar screen shall be designed to handle not less than the maximum septage hydraulic capacity flow rate noted in paragraph 1.03.C.2. with up to 4 percent solids concentration as well as the maximum clean water hydraulic capacity flow rate as noted in 1.03.C.3. at a maximum upstream liquid level as noted in paragraph 1.03.C.4. At the maximum screen upstream liquid level noted in paragraph 1.03.C.4., the net flow velocity through the screen openings shall not exceed 0.75 ft/sec at the maximum septage hydraulic capacity flow rate noted in paragraph 1.03.C.2. to maximize solids capture. The bar spacing noted in paragraph 1.03.C.6. shall be the clear opening between the fixed bar elements only. Screen designs that account for the specified spacing between a fixed bar element and adjacent reciprocating rake element (step screens), units that use perforated plate/wedge wire screen elements cleaned by a screw conveyor and brush system, or filter-type screens cleaned by washwater only will not be acceptable for this project.

C. The operation of the rake cleaning mechanism shall be automatically initiated at a preset high liquid level and controlled by the inlet valve and control system. The rake shall remove solids from the screenings basket and deposit them into the concentric screw conveyor trough after passing through a cleaning comb, where reverse movement of the rake shall provide positive cleaning of the rake mechanism. The screenings shall be transported up the screw conveyor and through a compression chamber.

D. The screening equipment shall wash the screenings prior to compaction and shall produce dewatered screenings capable of passing the EPA Paint Filter Test as described in method 9095B of EPA Publication SW-846.

E. Due to the abrasive nature of septage and scavenged sludges, there shall be no plastic-to-plastic, or plastic-to-metal wearing surfaces between the screening elements, conveying system or in the compaction/dewatering system.

F. Due to the presence of rocks and large objects in septage and scavenged sludges, the screen shall be capable of picking up objects 3-inches in diameter and depositing them for washing and passage through the compaction/dewatering zone.

G. Due to the high solids loadings in septage and scavenged sludges, the entire screen basket shall be completely cleaned in no more than the maximum allowable time noted in paragraph 1.03.C.8. to ensure minimum headloss and rapid cleaning of the screen. All open spaces of the screen shall be positively cleaned via teeth that pass through the full depth of the bars during each cleaning cycle. Spray wash water or screw flights with brushes will not be an acceptable method of cleaning the screen.

H. The control system shall be designed so that the cleaning characteristics of the screen can be changed via a selector switch to handle both "normal" septage/scavenged sludge loads and intermittent "grease" loads that contain a high fraction of material from grease traps. Systems that do not offer this feature will not be acceptable for this project.

I. The screen screw conveyor shall be capable of transporting a minimum of 35 cubic feet per hour of wet screenings.
1.06 SCREENINGS WASHING

A. Each screen shall be furnished with a minimum of two (2) separate screenings spray wash systems to flush organic material from the screenings prior to compaction and dewatering. The screenings washing systems shall be designed to minimize the amount of organic material in the screenings and to maximize solids dryness after compaction and dewatering.

B. Lower wash system shall be located immediately prior to the point where the screenings are removed from the screen and enter the screenings transport tube. This wash system shall pre-wash the screenings to remove fecal material and to prevent material from sticking to the screw conveyor flights.

C. Screenings wash system shall be located just prior to the beginning of the compaction zone after maximum maceration of the screenings by the screenings transport screw conveyor. At the maximum wash water flow rate noted in paragraph 1.03.C.17., the screw conveyor shall be designed to prevent screenings from being washed down the screenings transport tube to the basket.

1.07 ODOR CONTROL

A. To minimize odors and nuisance insect populations, the septage acceptance plant shall be completely containerized and enclosed from the inlet quick connect, through the inlet valve, screen basket, screenings washing system, screenings compaction/dewatering system, and discharge. The only components open to the atmosphere shall be the screenings discharge chute and the tank vent. Systems that do not provide a closed system described hereinbefore will not be considered for this project.

B. The design shall be such that all system components enclosed in the tank will be accessible via stainless steel gasketed access covers.

C. The tank enclosure shall be designed such that the 4-inch vent cap can be removed and the pipe can be connected to a future external odor control system.

1.08 SUBMITTALS

A. Shop drawing submittals shall be provided in accordance with Section ____.

1.09 MATERIALS QUALITY

A. All fabricated components of the screen shall be AISI Type 316 stainless steel including the screen basket, screw conveyor, outer screen housing, and support structure. Materials thicknesses identified in PART 2 - PRODUCTS are the minimum requirements for this project. Materials with increased thicknesses will be acceptable.

B. To ensure spare parts availability, all fabricated components shall be manufactured in the United States. To ensure prompt service and to ensure spare parts availability in a timely manner and at a reasonable cost, foreign fabricated materials of construction for the components identified in paragraph 1.09.A. will not be acceptable for this project.

1.10 QUALITY ASSURANCE
A. In order to assure uniform quality, ease of maintenance and minimal parts storage, it is the intent of these Specifications that a single manufacturer shall supply all equipment called for under this Section. The equipment manufacturer shall, in addition to the CONTRACTOR, assume responsibility for proper installation and function of the equipment.

B. Pilot Testing

1. Pilot testing shall be required of the proposed manufacturer if not named in the specifications or if the system being proposed differs in any way from the technical provisions of the PART 2 - PRODUCTS section.

2. Pilot tests shall begin within 14 days of notification by the OWNER at the Manufacturer's sole cost and expense. The manufacturer shall submit adequate proof of insurance to protect the interest of the OWNER.

3. Pilot testing shall entail a series of daily tests on the septage at the project site. Testing shall run for 8 hours per day, between the hours of 7:30 a.m. and 3:30 p.m. for a minimum of 30 days. The OWNER reserves the right to fix the actual date and times.

4. Power supply, septage, and water for testing will be furnished by the OWNER. The Manufacturer shall be required to connect to utilities points furnished by the OWNER.

5. All measuring devices and recording of measured data shall be the responsibility of the Manufacturer, subject to inspection and observation by the OWNER. A copy of all recorded data shall be turned over to the OWNER at the end of each day's testing. The OWNER will furnish all forms for recording data, and will perform all sampling and laboratory analysis if required. A copy of the laboratory analysis will be furnished to the Manufacturer. The Manufacturer shall submit a report on the test results of each series of tests within seven (7) calendar days after the completion of each series of tests. As a minimum, the report shall include the following for each of the 30 days:

   a. Time to unload each tanker  
   b. Flow rate (average) through the screen  
   c. Headloss through the screen  
   d. Wash water usage  
   e. Quantity of screenings removed  
   f. Recording of mechanical problems experienced  
   g. Organic fraction in the screenings  
   h. Solids content of the dewatered screenings

6. The owner reserves the right to eliminate the proposed equipment if the results of the pilot tests indicate that the test equipment will not accomplish the screenings required, if the amount of wash water required is, in OWNER’S sole opinion, excessive, or the power usage is, in OWNER’S sole opinion, excessive.

C. Naming a manufacturer in paragraph 2.01 does not relieve them from complying with the performance features, the salient features, and the Made in the U.S.A. requirements of the Contract Documents. The
Contract Documents represent the minimum acceptable standards for the septage preliminary treatment system equipment for this project. All equipment shall conform fully in every respect to the requirements of the respective parts and sections of the drawings and specifications. Equipment that is a "standard product" with the manufacturer shall be modified, redesigned from the standard mode, and shall be furnished with special features, accessories, materials of construction or finishes as may be necessary to conform to the quality mandated by the technical and performance requirements of the specification.

PART 2 - PRODUCTS

2.01 MANUFACTURER

   A. The Septage Acceptance Plant shall include all necessary equipment and appurtenances as manufactured by Lakeside Equipment Corporation, of Bartlett, Illinois, or pre-approved equal.

2.02 3-PLANE CYLINDRICAL BAR SCREEN

   A. Screen

       1. The 3-plane cylindrical bar screen shall be designed and built to withstand maximum possible static and hydraulic forces exerted by the liquid to the screen. All structural and functional parts shall be sized for the loads encountered during the screening, conveying and pressing operations. All submerged components and all components of the 3-plane cylindrical bar screen in contact with the screened solids shall be of stainless steel construction.

       2. The screen basket shall be of a cylindrical shape that shall be open at the top. The screen bars shall be perpendicular to the centerline of the screen. The basket ring support bars shall have adequately machined slots so that the rake teeth can penetrate the basket ring bars to ensure proper cleaning of the full basket depth.

       3. The screen basket shall use graduated depth bars to provide three (3) distinct screening planes (bar heights) on the screen interior to provide superior solids capture and removal from the flow. Designs that utilize a single bar height will not be acceptable for this project. The nominal bar spacing shall be as noted in paragraph 1.03.C.6. Perforated plate, fabric wire, wedge wire, or lamella plates will not be acceptable screen media.

       4. Each ring of the 3-plane cylindrical basket shall be fabricated from sections cut from flat 3/16-inch minimum thick stainless steel plate to minimize warping of the rings. Basket ring designs manufactured from rolled bar stock into rings will not be acceptable for this project. Each basket ring section shall be provided with an integral strengthening gusset at each attachment point to the support bars for added basket strength. The stainless steel support bars shall be machined with slots to provide the proper bar spacing as specified in paragraph 1.03.C.6. Each basket ring shall be inserted into the machined slot of the basket support bars and then welded to the support bars to provide a superior strength basket design. To ensure basket strength, the minimum ring heights for the 3-plane cylindrical basket shall be as follows:

           a. 3/4 inch
b. 1 inch

c. 1-1/2 inch

5. The main screen basket upper support ring shall be a minimum of 5/8-inch thick and shall be machined to match the transport tube main support flange to ensure proper alignment of the basket and the rotating rake arm in accordance with paragraph 2.15.F. The main screen basket lower support ring shall be 7/8-inch minimum thickness.

6. The minimum diameter of the screening basket shall be as noted in paragraph 1.03.C.7. The basket diameter shall be matched with a sufficient number of bar spacings to ensure the maximum hydraulic capacity flow rate noted in paragraph 1.03.C.3. is achieved and to provide less than the maximum headloss noted in paragraph 1.03.C.5.

7. Side seal plates shall be provided to enclose the circular screen and the tank. Side seal plates shall be two-piece fabricated of 10 gauge minimum stainless steel and shall be of sufficient height to prevent bypassing of flow around the screen at the maximum hydraulic capacity flow rate noted in paragraph 1.03.C.3.

8. A set of stainless steel lower screen basket support brackets fabricated of 1/4-inch sections shall be provided to support the basket in the tank. Support brackets shall allow vertical adjustment of the screen basket so that it does not rest on the tank floor.

B. Rotating Rake and Cleaning Comb

1. The rotating rake assembly shall penetrate the depth of the bar screen to ensure positive solids removal. Rake shall be water-jet or laser cut stainless steel for superior life. Designs using a fabricated rake head or that use a screw conveyor with a brush to clean the screen will not be acceptable for this project. Rake tooth root design shall match the 3-plane design of the basket rings to ensure proper cleaning of the screen bars.

2. The rake shall reverse at least once during the cleaning cycle to pass through the topmost position where it shall be cleaned by a water-jet or laser cut stainless steel hinged cleaning comb installed at the top of the screen basket. Fabricated cleaning comb designs will not be acceptable for this project. The cleaning comb shall be designed to match the rake profile to ensure cleaning of the spaces to the root of each tooth in the 3-plane rake design. Cleaning comb shall be supported at both ends and shall pivot and return to the standby position without the use of counterweights.

3. The rotating rake and the screw conveyor shall be fixed to the same shaft and driven by a common drive.

4. A stainless steel backed nylon brush shall be attached to the rake arm and positioned to make contact with the screening trough to sweep material caught on the edges of the trough.

C. Screenings Conveyor and Screenings Dewatering Press

1. The screenings screw conveyor transport tube nominal diameter shall be as noted in paragraph 1.03.C.9. with a minimum Schedule 10S pipe wall thickness. A minimum of three (3) anti-rotation bars with 1/4-inch minimum thickness shall be welded to the inside of the transport tube along the
longitudinal axis from the compaction zone to the beginning of the screenings collection trough. The screenings screw conveyor shall not depend on support from the anti-rotation bars during normal operation.

2. A basket support plate flange shall be a minimum of 3/4-inch and shall be welded to the lower end of the screenings transport tube complete with strengthening gussets to attach the screen basket and to provide for attachment of the screenings collection hopper. A 1/2-inch minimum thick drive support flange shall be welded to the upper end of the screenings transport tube for attachment of the drive assembly. After all welding of components to the screenings transport tube have been completed the fabrication shall be placed in a lathe to machine the face of the upper drive flange, to machine the face of the lower basket support plate flange for mating the basket and to machine the lower bearing housing in accordance with paragraph 2.15.F. A 1/2-inch thick minimum drive assembly adaptor stainless steel flange shall be provided to bolt to the upper drive support flange.

3. The dewatering screw shall be designed to transport and dewater the screened material. Screw flights shall be stainless steel with a minimum thickness of 3/16-inch with increased 3/8-inch thick minimum thickness in the screenings collection trough and in the compaction and dewatering zone. Flight pitch distance shall be a maximum in the screenings collection hopper and shall be reduced along the length of the screenings transport tube to a minimum pitch distance in the compaction zone. Constant pitch screenings screw conveyor designs will not be acceptable for this project.

4. The upper and lower screenings conveyor torque tube shall be fitted with a solid stainless steel stub shaft. The shafts and screenings screw conveyor torque tube shall be accurately machined in accordance with paragraph 2.15.F. to allow a shrink-fit and welded design for the upper drive end stub shaft and lower tail bearing stub shaft. Bolting the stub shafts to the screening transport screw conveyor torque tube will not be acceptable for this project.

5. The lower end of the screenings conveyor shall be supported by a sealed, self-lubricated lower polymeric composite sleeve bearing with stainless steel wear sleeve. Metallic-based lower bearings will not be acceptable for this project. The lower bearing shall not take any thrust load from the screw conveyor. A minimum of two seals shall be provided each with a UHMW polyethylene seal retainer plate. The stainless steel bearing housing shall be field replaceable and shall be machined in accordance with paragraph 2.15.F. to mate with the screenings collection housing by a bolted connection. Designs in which the bearing housing is welded directly to the screen body will not be acceptable for this project.

6. Rake arm attachment hub outer diameter shall match the outer diameter of the stationary bearing housing to minimize material wrapping around the shaft. A seal plate shall be furnished to mate between the stationary lower bearing support and the rotating arm to prevent material intrusion into the bearing seals. The rake arm attachment hub shall be split to provide compression fit along with a key and keyway.

7. Drainage holes shall be provided along the entire length of the screenings collection trough invert to allow for gravity drainage of washwater without flushing screenings out of the trough. Drainage hole diameter shall be equal to or smaller than the bar spacing noted in paragraph 1.03.C.6. The width of the drainage section shall be based upon a minimum 65-degree arc. The drainage section perforated plate material shall be fabricated from 11 gauge minimum thick stainless steel and shall have a minimum 50% open area for free water drainage.
8. A compaction zone shall be an integral part of the screenings screw conveyor and transport tube design. The compaction zone shall be designed to form a screenings plug of material and to return water released from the screened material back to the tank through circular holes that are machined into the screenings transport tube. Compaction zone shall be fabricated from 12 gauge minimum thick stainless steel welded to the screenings transport tube to provide a watertight screenings pressate collection chamber. Compaction zone housings that are non-metallic and which require seals to prevent leakage around the screenings transport tube will not be acceptable for this project. The compaction zone housing shall be furnished with an outer hinged and sealed access cover held in place with stainless steel latches. An interior dewatering section panel inside the dewatering chamber shall be provided. The interior dewatering section panel shall be held in place via heavy-duty stainless steel band clamps to allow direct access to the screw conveyor should the compaction zone ever become plugged. Designs that require removal of the drive assembly, discharge head or screw conveyor to gain access to the compaction zone will not be acceptable for this project.

9. Water that is released from the screenings shall be returned via a reinforced rubber hose attached to the dewatering section. Drain design shall allow for removal and cleaning of the drain hose should it ever become plugged without removing the drive, discharge head or screw conveyor.

10. Screen minimum invert to discharge height shall be as noted in paragraph 1.03.C.10.

D. Drive Assembly

1. The rake mechanism and transport screw shall be driven by a direct-connected, cycloidal-helical, hollow-shaft, high-thrust, in-line speed reducer. The cyclo element of the speed reducer shall be designed to take a 500 percent shock load without damage. The speed reducer manufacturer shall be a member of AGMA. Combination gear motor designs will not be acceptable for this project. The speed reducer shall have a minimum service factor as noted in paragraph 1.03.C.11., a minimum torque rating as noted in paragraph 1.03.C.12., and a minimum thrust rating as noted in paragraph 1.03.C.13. at the design output speed of the reducer.

2. The speed reducer shall be bolted to the drive adaptor flange at upper end of the screenings transport tube.

3. The speed reducer shall be driven by a field-replaceable NEMA C-flanged, 1,800 rev/min, ball bearing, continuous-duty, totally-enclosed, fan-cooled motor with leads to a large conduit box. Motor size shall be as noted in paragraph 1.03.C.14., shall be rated for electrical power characteristics as noted in paragraph 1.03.C.15. and shall be rated for an electrical environment as noted in paragraph 1.03.C.16.

4. Chain-drives, belt drives, hydraulic drives or a separate upper bearing for the transport screw will not be acceptable for this project.

5. A proximity sensor for locating the rake position shall be mounted to the outer drive housing with a fabricated stainless steel bracket. Limit switches or other electro-mechanical position sensing devices will not be acceptable for this project.
E. Wash Systems

1. Three (3) wash systems shall be provided. Each wash system shall be furnished with a control solenoid valve, stainless steel piping and fittings, flexible reinforced PVC hose and nozzles. Piping, fittings and valves shall be 3/4-inch diameter minimum. A plant water strainer shall be provided for the incoming plant water supply. The wash water flow requirements shall be as noted in paragraph 1.03.C.17. with a minimum pressure as noted in paragraph 1.03.C.18. The three (3) wash systems shall include:

   a. **Lower wash system** shall be located near the upper end of the screenings basket just prior to where screenings enter the screw conveyor transport tube. The lower wash system shall have the minimum of spray nozzles as noted in paragraph 1.03.C.19. Lower spray wash bars without replaceable spray nozzles will not be acceptable.

   b. **Screenings wash system** shall be located in the upper section of the transport tube no more than 17 inches from the beginning of the compaction zone to break up and return organic materials to the flow stream and to ensure maximum screenings washing. The screenings wash system and screenings screw conveyor shall be designed to prevent washing screenings down the center of the screw conveyor.

   c. **Dewatering chamber flush water system** shall periodically clean the compaction and dewatering zone via a stainless steel wash nozzle located in the compaction/dewatering chamber. The dewatering chamber flush water system shall not be a substitute for the screenings washing systems described in paragraphs 2.02.E.1.a. and 2.02.E.1.b.

2. The three (3) wash system solenoid valves shall be 3/4-inch minimum, brass body suitable for 120 VAC operation with an electrical rating as noted in paragraph 1.03.C.16. Solenoid valves shall be normally closed and rated for up to 150 psig. Solenoid valves shall be slow close type to minimize water hammer.

3. Solenoid valves shall be factory installed to a piping manifold to ensure even pressure distribution to each spray wash system. The solenoid valve wiring shall be factory installed to a common junction box on the spray wash manifold for wire nut connection to external power. Conduit and fittings shall be factory installed between the solenoid valves and junction boxes. Junction box, conduit and fittings shall be rated NEMA 4X for a non-hazardous electrical environment as noted in paragraph 1.03.C.16.

4. Water strainer shall be provided that is suitable for a 3/4-inch NPT connection and a maximum flow rate as noted in paragraph 1.03.C.17. and suitable for a maximum pressure of 125 psig. Water filter shall be a stacked filter element design with washable 80-mesh (200 micron) polyethylene or polypropylene disc elements, polypropylene head and bowl and Buna N gaskets. Y-type strainers will not be acceptable for this project.

2.03 SCREENINGS BAGGER

A. The discharge chute shall be furnished with a bagging device to contain and encase dewatered screenings.
B. The bagging device mounting assembly shall be fabricated of 12 gauge minimum stainless steel.

C. The screenings bagger attachment shall be designed to be fitted with a continuous hose cassette. Bagger shall be supplied with two continuous hose cassette.

2.04 HOUSING

A. The screen housing shall be constructed of stainless steel with minimum 10 gauge thick sides and bottom and minimum 3/16-inch end plates. Housing shall be adequately stiffened to prevent distortion due to the liquid sludges. Support legs shall be provided for anchoring to a base slab and lifting lugs shall be furnished for unloading the tank. The screen housing shall have a minimum width as noted in paragraph 1.03.C.20., a minimum length as noted in paragraph 1.03.C.21. and a minimum height as noted in paragraph 1.03.C.22.

B. An aluminum cam and groove quick-connect coupling shall be provided for the inlet connection. Coupling and inlet piping size shall be as noted in paragraph 1.03.C.23. Inlet connection shall be Schedule 40S stainless steel pipe. Inlet piping centerline above grade shall be as noted in paragraph 1.03.C.24. to allow for complete gravity unloading of a septage tanker and to maximize the flow capacity from the tanker to the septage acceptance plant. The tank shall be provided with a curved inlet baffle that shall extend the entire width of the tank to help contain splash and spray.

C. An inlet pinch-type valve of the size noted in paragraph 1.03.C.23. shall be provided for controlling flow into the unit. Pinch valve shall be a Red Valve Type A design with cast iron body with ANSI Class 125/150 flanges. The elastomer shall be Buna-N. Valve shall operate at a minimum pressure of 50 psig and shall use approximately 0.5 cubic feet of water per open or close cycle. A 3/4-inch 3-way solenoid valve shall be provided to control the pinch valve operation and shall be suitable for 120 VAC operation with an electrical rating as noted in paragraph 1.03.C.16.

D. Outlet diameter shall be provided as noted in paragraph 1.03.C.25. and shall accept an ANSI 125 lb flanged bolt pattern.

E. The tank housing shall be provided with minimum 10-gauge thick stainless steel lift off access covers complete with gaskets and quarter turn hold down stainless steel captive fasteners. Cover shall be an inset design to ensure that no leakage occurs should the gasket material fail.

F. The tank shall have a 4-inch vent and removable cap.

H. The tank shall include a 6-inch diameter cleanout. It shall be installed upstream from the screen enabling removal of rocks and other debris. The cleanout shall have a 6-inch aluminum cam & groove male adapter with water tight dust cap.

2.05 HOUSING WASHING SYSTEM

A. There shall be provided a wash system for the housing that shall be constructed with stainless steel piping, flexible reinforced PVC hose and a spray nozzle.

B. The system shall automatically clean the inside of the housing after a preset idle period.
C. The nozzle shall be fabricated of nylon driven by the flow of the wash water at a minimum flow of 20 gal/min at 60 psig. The orifices shall be precisely positioned to provide complete coverage of all interior tank surfaces.

D. Spray wash system shall be controlled via a solenoid valve as noted in paragraph 2.02.E.3.

2.06 EXTERNAL ROCK TRAP

A. An external rock trap shall be provided and shall be fabricated of AISI Type 316 stainless steel with a storage capacity of not less than 5 cubic feet. The external rock trap shall be located after the inlet control valve and prior to the magnetic flow meter and septage acceptance plant tank. Piping to and from the rock trap shall be provided by others.

B. The rock trap housing shall be constructed of a 24-inch diameter Schedule 20 stainless steel pipe with a ¼-inch thick end plate at one end and a hinged cover assembly with O-ring at the other end. Support legs shall be provided for anchoring to a base slab and lifting lugs shall be furnished for unloading the housing. Support legs shall be adjustable ± 3/4 inches in vertical height for allowing leveling of the unit. Support leg height shall be determined by the inlet piping arrangement.

C. The external rock trap inlet and outlet diameter shall be as noted in paragraph 1.03.C. 24 and fabricated of Schedule 40S stainless steel pipe each with a 4-inch minimum long plain end pipe stub.

D. Two (2) stainless steel ball valves shall be provided at the bottom of the rock trap housing, one (1) 2-inch NPT ball valve to connect to the plant water supply for flushing out the rock trap and one (1) 2-inch NPT ball valve for draining the rock trap to a nearby drain. Pipe fittings for the flushing and drain system shall be Schedule 40S stainless steel with NPT threads.

2.07 MAIN CONTROL SYSTEM

A. All controls necessary for the fully automatic operation of the screen and supporting equipment shall be provided in accordance with NEMA standards.

B. A position sensor and target shall be externally-mounted on the drive unit for ease of operator access and shall provide a “home” location for the 3-plane cylindrical bar screen operation during the cleaning cycle. Position sensors with internally-mounted targets inside the screenings screw conveyor will not be acceptable for this project.

C. The electrical control system shall provide for automatic control of the screen via a high liquid level using a liquid level control system in connection with an adjustable time clock. The screen shall operate at a high liquid level or a pre-determined time sequence to provide a variable time between cleaning operations.

D. The ultrasonic level sensing system shall be a Siemens-Milltronics MultiRanger 100 with programmer and an ST-H level transducer that is suitable for an environment as noted in paragraph 1.03.C.16. Ultrasonic level transducer shall be mounted to the top cover of the tank. Conduit and fittings shall be factory installed between the ultrasonic level transducer and junction box along with flexible conduit. Junction box, conduit, and fittings shall be rated NEMA 4X for a non-hazardous electrical environment as noted in paragraph 1.03.C.16.
E. A local-mounted main control panel suitable for wall mounting shall contain the following items:

1. Door interlocked fused disconnect
2. Allen-Bradley MicroLogix 1100 programmable logic controller (PLC) with LCD display, 10/100 Base T Ethernet port, relays and timers to monitor equipment-mounted electrical devices and to perform necessary logic functions
3. Square D Altivar 31 variable frequency drive (VFD) with line reactor
4. Control power transformer fused primary and secondary with 120 VAC transient voltage surge suppressor (TVSS)
5. HAND-OFF-AUTO selector switches for the following:
   a. Screen drive
   b. Common wash system for the screen solenoid valves
   c. Tank wash system solenoid valve
6. FORWARD-OFF-REVERSE selector switch (spring return to center) for screen drive
7. E-STOP pushbutton (Red)
8. CYCLE/RE-SET pushbutton (Black)
9. Full-voltage LED pilot lights for the following:
   a. Control power ON (White)
   b. Screen RUN (Green)
   c. Multifunctional overload shutdown/screen FAULT (Red)
   d. High water level ALARM (Red)
10. Non-resettable elapsed time meter for the screen drive
11. Remote dry contact outputs for the following:
    a. Screen RUN
    b. Multifunctional overload shutdown/screen fault ALARM
    c. Screen upstream high water level ALARM
12. Combination alarm horn and flashing alarm light with SILENCE-RESET pushbutton
13. Weather protection system heat tracing circuit breaker
14. Plant water heat tracing (250 WATTS MAX BY CONTRACTOR) circuit breaker
15. White phenolic nameplates with black lettering
16. 600 VAC terminal block
17. U.L. panel label per the application
18. Electrical enclosure in accordance with paragraph 1.03.C.26.

2.08 MAGNETIC FLOW METER

A. A 6-inch diameter magnetic flow meter shall be provided and installed in the inlet piping. The flow tube shall be a wafer style, Yokogawa Model AXF100C-E1AL1L-AA11-21B/FF1. The flow tube shall include grounding rings for mounting between ANSI Class 150 flanges that shall be furnished by the CONTRACTOR. The grounding rings and electrodes shall be AISI Type 316L stainless steel. All process-wetted materials in the body of the flow tube shall have a fluorocarbon PFA lining. A 1/2-inch FNPT electrical connection shall be provided. The transmitter shall include an operator interface 3-line LCD display and shall produce an analog output signal of 4-20 mA, pulse output, and HART communication. The power supply shall be 100 to 240 VAC or 100 to 120 VDC. The magnetic flow meter assembly shall be FM approved for a Class I - Division 1 explosion proof electrical environment. Protection shall be IP67, NEMA 4X, immersion-proof type. The flow meter shall provide 0.35% accuracy of reading standard with standard factory calibration.
B. Allowances shall be made in the piping by the CONTRACTOR to accommodate a minimum meter run of 5 pipe diameters upstream and 2 pipe diameters downstream from the flow tube.

2.09 SECURITY ACCESS SYSTEM

A. Use of the Septage Acceptance Plant system shall be for authorized dischargers only, with access controlled by the control system. Initial activation of the system shall require use of a plant assigned PIN number. The system shall be capable of supporting a minimum of 300 authorized dischargers. Activation of the system shall open the inlet control valve, permitting septage or scavenged sludges to be discharged into the plant. Upon completion of unloading, a receipt with discharge information shall be printed for each user. If the discharge cycle is stopped due to a fault, the fault information shall be printed on the receipt.

B. The system shall store hauler authorization criteria in a non-proprietary formatted file located in the non-volatile storage memory of the operator interface.

C. The hauler authorization criteria file shall be editable on a computer system external of the hauler access control station.

D. The system shall be capable of securely accepting a modified hauler authorization criteria file electronically from a remote source.

E. The hauler criteria authorization file shall be capable of identifying authorized haulers by name in addition to hauler ID number. The hauler name shall be printed on the receipt and kept in the hauler discharge information data file. Systems that are not capable of identifying the hauler by name shall not be acceptable.

F. The system shall be capable of a minimum of five (5) years of retention of hauler discharge information. Hauler discharge information shall be kept in a non-proprietary data format.

G. The system shall retain electronic backup copies of all discharge data in two (2) different storage locations.

H. Upon activation of system, the controls shall provide for automatic control of the associated inlet control valve by opening it to allow the hauler to utilize the system. The inlet control valve shall also be automatically controlled with high liquid level conditions in screening chamber using the screen’s ultrasonic liquid level control system. If provided, a zero flow empty pipe sensor in the inlet pipe shall allow the controls to automatically close the inlet valve after a pre-determined time period or when the stop button is pressed.

I. Each Hauler Access Control Station shall include the following components:

1. Allen-Bradley MicroLogix 1100 programmable logic controller (PLC) with LCD display, Ethernet communications port, and back-up memory module. The PLC shall be used for control and signals processing functions only and shall not be used for data storage
2. Allen-Bradley PanelView Plus 700 Human Machine Interface (HMI), color display, Web studio runtime, Ethernet communications port, USB ports, compact flash card port, 2 GB minimum flash card, and pack of five (5) replaceable screen overlay covers
3. 2 GB minimum SD Card for data back-up and data transfer
4. Panel-mounted receipt printer complete with the following:
   a. Serial interface
   b. Auto-cutter device for receipt delivery
   c. Front-loaded 2-1/4 inch wide thermal printer paper
   d. Two (2) paper rolls
5. Panel heater with thermostat
6. Transient voltage surge suppressor (TVSS)
7. MCR safety circuit
8. Ethernet switch, 5 port, 10/100, Cat 5
9. External USB interface for data transfer
10. E-STOP Pushbutton
11. Flashing alarm light (red)
12. NEMA 4X stainless steel enclosure with weather-proof hinged transparent instrument cover

2.10 DATA MANAGEMENT AND ACCOUNTING SYSTEM (OPTIONAL)

A. The Security Access System shall include an automated accounting system software package that enables plant personnel to administer the septage and scavenged sludge haulers. The accounting system shall use an off-the-shelf accounting software package from a major software manufacturer. Systems that utilize proprietary accounting or data transfer software shall not be acceptable for this project. This software package shall be installed on a Windows based computer, which shall act as the central computer for the accounting system.

B. The accounting system software shall allow the OWNER to:

1. Automatically or manually receive data from Hauler Access Control Stations supplied as part of the septage receiving equipment
2. Manage septage hauler companies and truck identification information
3. Generate invoices and receive payments
4. The OWNER shall be able to assign the billing method as:
   a. Tank volume (gallons unloaded).
   b. Discountable single rate.
   c. Variable rate based on septage classification.
5. Generate standard reports that are available from the accounting system software
6. Record the date, time, gallons, and waste type for each load
7. Permit entry of a minimum of five (5) waste types with individual cost per gallon charge
8. Allow manual entry/import of load transactions

C. The accounting system shall be capable of connecting to a minimum of ten (10) hauler access control stations.

D. All communications between the Hauler Access Control Stations and Invoice System computer shall be over a 10/100 BASE-T Ethernet connection.
E. The accounting system shall be provided with a personal computer. The personal computer shall meet the following minimum hardware and software requirements:

1. Management and Accounting System software with a utility software setup CD and instructions for installation
2. Windows 7 or 8, natively installed
3. 2.4 GHz processor
4. 8 GB of RAM
5. 2.5 GB of available disk space (additional space required for data files)
6. 19-inch flat panel display monitor with display resolution of 1024 X 768 at 16-bit or higher color
7. 4x speed CD-ROM drive
8. Internet Explorer 10 (R3 and later)
9. Keyboard
10. Wireless optical mouse
11. 10/100 Ethernet card

F. The PC hardware and software shall be configured as part of the septage receiving system. The automated accounting system software package shall be furnished and tested as a complete system with the controls furnished by the septage equipment manufacturer/control panel manufacturer.

2.11 COLD WEATHER PROTECTION

A. The septage acceptance plant tank and screenings discharge transport tube shall be furnished with a heat tracing system for cold weather protection.

B. The wash system solenoid valves and piping manifold specified in paragraphs 2.02.E. shall be mounted in a stainless steel enclosure with a hinged door that is lockable. The enclosure shall be provided with an internal heater to prevent freezing. The enclosure shall be mounted on the side of the tank.

C. The heat tracing system shall be suitable for operation to a minimum temperature of -25°C (-13°F) and shall be powered from the main control panel.

D. The cold weather protection system shall include heat tracing with thermostat, a minimum of 2 in. of insulation and a 12 gauge minimum stainless steel protective jacket for the tank only. Jacket splices shall be provided with sealant to prevent water intrusion into the insulation.

E. The screenings transport tube shall be covered with a protective molded fiberglass reinforced polyester laminate jacket with the exterior surface gel coated for ultraviolet radiation protection. Fiberglass shall have a glass content of not less than 30%, a tensile strength of not less than 22,000 psi, a flexural strength of not less than 25,000 psi and Barcol hardness of not less than 40. Finished fiberglass must withstand a temperature of 200°F without blistering, pinholes, warping or other defects. Gel coat shall be provided with impregnated pigment for exterior light gray color. The weather protection package cover shall be designed to support a wind load of 30 lb per square foot.

F. The weather protection package fiberglass cover sections shall be split into two sections when mounted axially along the transport tube. Weather protection system fiberglass cover sections shall extend from the discharge chute over the compaction and dewatering zone and down to the main basket support flange gussets. Each split fiberglass cover section shall be connected via fiberglass flanges and stainless
steel nuts, bolts and washers. Each fiberglass cover section shall be designed so that the insulation is completely encapsulated within the fiberglass to prevent water intrusion and damage. Designs with loose non-encapsulated insulation will not be acceptable for this project. Each fiberglass half section shall be approximately 2 ft long with molded fiberglass flanges. Individual sections shall be connected via fiberglass flanges and a stainless steel V-ring captive clamping system for easy installation and removal.

G. Where the wash water supply and electrical wiring conduit penetrates the fiberglass cover bulkhead adapters shall be provided.

H. All fasteners to assemble the fiberglass cover components shall be stainless steel.

A. A fabricated composite weather enclosure shall be provided for the water strainer specified in paragraph 2.02.E.4. Enclosure shall be provided with a removable cover.

B. The plant water supply system piping to the screen and the water strainer described in paragraph 2.02.E.4 shall be provided with heat tracing and insulation by the CONTRACTOR. The MANUFACTURER’S control panel shall be provided with sufficient low voltage power to handle up to an additional 250 watts from the CONTRACTOR supplied plant water heat tracing system.

2.12 ANCHOR BOLTS

A. Equipment manufacturer shall furnish all anchor bolts of ample size and strength required to securely anchor each item of equipment. Anchor bolts, hex nuts, and washers shall be AISI Type 316 stainless steel unless noted otherwise.

B. Anchor bolts shall be set by the CONTRACTOR. Equipment shall be placed on the foundations, leveled, shimmed, bolted down, and grouted with a non-shrinking grout.

2.13 SPARE PARTS

A. The following spare parts shall be provided:

1. One (1) set of rake heads and cleaning combs with stainless steel mounting hardware
2. One (1) complete solenoid valve assembly
3. One (1) solenoid valve re-build kit
4. One (1) lower bearing element with stainless steel wear sleeve and seals
5. Three (3) spare fuse sets of each size and type
6. Two (2) hose bagger cartridges for the continuous baggers

B. Spare parts shall be individually boxed with the project name and part number clearly identified on each individual box. All spare parts shall be shipped in a separate crate and clearly labeled. Spare parts shall be stored indoors by the Contractor in a temperature-controlled environment.

2.14 SHOP SURFACE PREPARATION AND PAINTING

A. Electric motors, speed reducers, and other self-contained or enclosed components shall have manufacturer's standard enamel finish.
B. All external non-wetted stainless steel shall be cleaned to a uniform finish by glass bead blasting and chemically treating with Citrisurf 2210 or 2050. No hazardous wastes shall be produced during fabrication because Citrisurf is a citric acid based product that is non-toxic. The septage acceptance plant manufacturer shall clearly identify the passivation procedure methodology and shall certify that no hazardous wastes were produced.

2.15 SOURCE QUALITY CONTROL

A. All structural stainless steel components shall be fabricated in the United States and shall conform to the requirements of "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" published by the American Institute of Steel Construction.

B. All parts and assemblies shall be fabricated from sheets and plates of AISI Type 316 stainless steel conforming to ASTM A666, unless noted otherwise. All rolled or extruded shapes shall be fabricated to conform to ASTM A276. All tubular products and fittings shall be fabricated to conform to ASTM A269, A351 and A403.

C. All welding in the factory shall use shielded arc, inert gas, MIG or TIG method. Add filler wire to all welds to provide for a cross section equal to or greater than the parent metal does. All butt welds shall be full penetration type to the interior surface. Provide gas shielding to interior and exterior of the joint.

D. Welding of the screen components shall be in accordance with the latest edition of the American Welding Society (AWS) standards. Field welding of stainless steel will not be permitted.

E. Bolts, nuts, and washers shall be AISI 316 stainless steel furnished in accordance with ASTM A193.

F. All surfaces that are specified to be machined shall be designed and fabricated to provide a runout of not more than 0.005 inches and a concentricity to within 0.005 inches.

G. Design and fabrication of structural steel members shall be in accordance with AISC and AWS Standards. The manufacturer shall comply with the American Welding Society (AWS) and the American Institute of Steel Construction (AISC) most current listed standards and qualifications in 2004 D1.1, the criteria per the requirements of Section 6 - Inspection - Structural Welding Code. Evidence of such AWS and AISC compliance shall be submitted with shop drawing submittals as follows:

1. AWS Certified Welding Inspectors (minimum 2 on staff) shall conform to all standards, current or previous as listed in section 6.1.4 AWS QC1, Standard and Guide for Qualification and Certification of Welding Inspectors.

2. AWS Non Destructive Testing Inspectors (Level I, II, III) for Magnetic Particle and Ultra-Sonic testing (minimum 2 on staff) shall conform to all standards, current or previous as listed in and in conformance with The American Society for Non-Destructive Testing (ASNT-TC-1A).

**PART 3 - EXECUTION**
3.01 SHOP TESTING

A. Prior to shipment of the equipment the screen shall be operated for a minimum of four (4) hours at the fabrication location with the specific drive motor that will be furnished for the project at the actual operating angle of the screen for the project.

B. During the shop test the following parameters shall be recorded:

1. Motor serial number
2. Amperage draw at start-up, after two hours and after four hours during forward operation
3. Amperage draw during reverse operation

C. A certified shop test report shall be submitted to the ENGINEER.

3.02 FIELD PREPARATION AND PAINTING

A. Finish field preparation and painting shall be performed as specified in Section _______.

B. The CONTRACTOR shall touch-up all shipping damage to the paint and stainless steel as soon as the equipment arrives on the job site.

C. The CONTRACTOR shall supply paint for field touch-up and field painting.

D. The CONTRACTOR shall finish paint electrical motors, speed reducers, and other self-contained or enclosed components with oil-resistance enamel.

E. Prior to assembly all stainless steel bolts and nut threads shall be coated with a non-seizing compound by the CONTRACTOR.

3.03 INSTALLATION

A. The manufacturer shall schedule two (2) trips to the project site for equipment start-up assistance as noted in paragraph 3.02.B. for the CONTRACTOR and for operating training as noted in paragraph 3.03.C. for OWNER personnel.

B. After the CONTRACTOR has installed the Septage Acceptance Plant and unit is capable of being operated, the equipment manufacturer shall furnish a qualified representative for a minimum of three (3) 8-hour days (up to 24 hours) to perform start-up inspection of the equipment and training for the CONTRACTOR.

C. After the equipment has been placed into operation, the manufacturer's representative shall make all final adjustments for proper operation.

3.04 FIELD TESTING

A. Prior to final acceptance of the screen, three (3) tests shall be conducted according to the EPA Paint Filter Test as described in method 9095B of EPA Publication SW-846.
B. Should the system fail to produce screenings capable of passing the "EPA Paint Filter Test", the manufacturer shall at its own expense make all necessary modifications to the equipment until such tests can be passed.

3.05 OPERATOR TRAINING

A. Provide operator training for OWNER'S personnel after system is operational. Training will take place while manufacturer's representative is at the job site for inspection.

END SECTION 11333
PART 1: GENERAL

1.01 SCOPE

A. CONTRACTOR shall furnish, install and place into satisfactory operating condition a Septage Receiving Station consisting of a Drum Screen and Wash Press (WAP) for removing floating, particulate and fibrous material and for conveying the material for discharge into screening bags; as shown on the Drawings and described in the Specifications.

B. It is the intent of these Specifications that all equipment called for under this Section shall be supplied by a single manufacturer.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:

B. Anti-Friction Bearing Manufacturers Association (AFBMA) Publications:

C. American Institute of Steel Construction (AISC) Publications

D. American Welding Society (AWS) Publications

E. American Structures Painting Council (ASPC) Publications

1.03 SUBMITTALS

The following information shall be submitted to the Engineer. In accordance with Section 01300, copies of all materials required to establish compliance with this Section. Submittals shall include the following:

A. Product Data: Include the following:
   1. Descriptive literature, brochures, catalogs, cut-sheets and other detailed descriptive material of the equipment.
   3. Gear reducer data including service factor, efficiency, torque rating, and materials.
4. Parts list including a list of recommended spare parts.

B. Shop Drawings: Include the following:
   1. Manufacturer’s installation drawings.
   2. Wiring and schematic diagrams.

C. Operations and maintenance manual: See Section 01300.

D. Detailed installation instructions, with clear step-by-step points on the correct mechanical and electrical installation procedures.

E. Equipment weights and lifting points.

F. Recommendations for short and long term storage.

G. A copy of the manufacturer’s warranty.

H. A copy of documents proving certification of the Manufacturer’s Quality Management System according to ISO 9001 and Environmental Protection Management System according to ISO 14001.

I. Failure to include all drawings applicable to the equipment specified in this section will result in rejection of the entire submittal with no further review.

1.04 QUALITY ASSURANCE

A. To ensure quality, conformance, and reliability with regard to the manufacturing and production of the equipment, the manufacturer shall meet all requirements listed hereafter:

B. Manufacturer shall have a minimum of twenty (20) years experience producing equipment substantially similar to that required and shall be able to submit documentation of at least ten (10) independent installations using the equipment for septic sludge screening as detailed in the below. Each installation must have been in satisfactory operation for at least three (3) years.

C. The Contract Documents represent the minimum acceptable standards for the screening equipment for this project. All equipment shall conform fully in every respect to the requirements of the respective parts and sections of the drawings and specifications. The entire unit shall be Manufacturer’s standard product, but shall be modified, redesigned, furnished with special features or accessories, made of materials or provided with finishes as may be necessary to conform to the quality mandated by the technical and performance requirements of the specification.

D. The entire unit shall be manufactured from AISI 316L stainless steel shapes. All components made of stainless steel shall be passivated by full submersion in a pickling bath for perfect surface finishing. No stainless steel components may be fabricated or assembled in a factory where carbon steel products are also fabricated, in order to prevent contamination by rust.

E. Electric motors, gear reducers, and other self-contained or enclosed components shall have an acrylic enamel finish.

F. All stainless steel components and structures shall be submersed in a chemical bath of nitric acid and hydrofluoric acid (pickling bath) to remove any residues that may be present on the material.
as a result of forming, manufacture, or handling. After removal from the pickling bath, the
equipment must be washed with a high-pressure wash of cold water to remove any remaining
surface debris and promote the formation of an oxidized passive layer which is critical to the long
life of the stainless steel. No stainless steel components may be fabricated or assembled in a
factory where carbon steel products are also fabricated, in order to prevent contamination by rust.
Glass bead or sand blast or chemically treatment processes not based on nitric acid / hydrofluoric
acid for stainless steel shall not be allowed.

G. Fabrication shall be done in compliance with all applicable ASTM standards or equivalent
international standards.

H. All welding in the factory shall use shielded arc, inert gas, MIG or TIG method. Filler wire shall be
added to all welds to provide for a cross section equal to or greater than the parent metal. Butt
welds shall fully penetrate to the interior surface and gas shielding to interior and exterior of the
joint shall be provided.

I. Bolts, nuts and washers shall be 316L stainless steel such that they are anti-seizing.

J. Manufacturer shall have established an ISO 9001 certified quality management system.
Equipment suppliers not utilizing ISO 9001 facilities shall not be considered or approved for this
project. Equipment supplier shall provide evidence of certification before being named as an
acceptable manufacturer.

K. Manufacturer shall have established an ISO 14001 certified environmental protection
management system designed to monitor and help minimize the harmful effects on the
environment caused by its manufacturing processes. Equipment suppliers not utilizing ISO
14001 facilities shall not be considered or approved for this project. Equipment supplier shall
provide evidence of certification before being named as an acceptable manufacturer.

L. All welding is performed in accordance with American Welding Society (AWS) D1.1 Structural
Welding Code, or equivalent.

M. Manufacturer shall provide drum screen, wash press, motors, gear reducers, controls, control
panels, and lifting attachments as a complete integrated package to ensure proper coordination,
compatibility, and operation of the system. The manufacturer shall test-run the fully assembled
machine in his factory before shipment.

N. Manufacturer shall provide services by a factory-trained Service Engineer, specifically trained on
the type of equipment specified. The Service Engineer requirements include, but are not limited
to the following:

1. The Service Engineer shall be present during initial energizing of equipment to determine
directional testing as described in Section 7.03 C (Installation).

2. The Service Engineer shall inspect and verify location of anchor bolts, placement,
leveling, alignment and field erection of equipment, as well as control panel operation and
electrical connections.

3. The Service Engineer shall provide classroom and/or field training on the Operation and
Maintenance of the equipment to operator personnel. These instructions may include the
use of slides, videos, literature, and/or oral presentations.

4. Manufacturer shall state field service rates for a Service Engineer to Owner and
Contractor. In the event that the field service time required by this section should not be
sufficient to properly place the equipment into operation, and the requirement for
additional time is beyond the manufacturer’s responsibility, additional time shall be
1.05  ENGINEER’S PRE-APPROVAL OF ALTERNATE EQUIPMENT

A. Manufacturer of alternate equipment shall submit a pre-approval package to Engineer at least two (2) weeks prior to bid date. Alternate manufacturer shall submit the following information and supporting documentation:

1. A complete set of drawings, specifications, catalog cut-sheets, and detailed descriptive material. Drawings shall show all relevant details of the unit. This information shall identify all technical and performance requirements stipulated on the drawings and in the specification. If the proposed equipment does not meet these specifications, any deviation from the specification must be expressly noted. All deviations shall be listed on a single document.

2. Detailed installation drawings illustrating how the proposed system fits and where it will be installed. The drawings shall include plan, elevation, and sectional views of the installation. Drawings shall include details of anchor bolt locations.

3. Motor characteristics and performance information. Vendor data shall be furnished to confirm the torque and thrust rating of the drive.

4. Complete reference list of all installations of same and similar equipment including contact names and phone numbers, showing at least 25 installations of the same type and size as specified.

5. Complete bill of materials for all equipment, showing dimensions and materials of construction of all components.

6. Certification by the manufacturer that all stainless steel equipment will be manufactured in a stainless steel only factory.

7. Certification that the entire equipment will be passivated by submersion in an acid bath as specified in chapter 2.02.P.

8. A copy of documents proving certification of the Manufacturer’s Quality Management System according to ISO 9001 and Environmental Protection Management System according to ISO 14001.

9. Details of the control and instrumentation system including wiring diagrams.

10. Information on equipment field erection requirements including total weight of assembled components and weight of each sub-assembly.

11. List of recommended spare parts.

12. A maintenance schedule showing the required maintenance, frequency of maintenance, lubricants and other items required at each regular preventative maintenance period, including all buy-out items.
PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Base Bid: Rotamat Wash Drum RoFAS size 1, WAP size 6 from Huber Technology, Inc.

B. Equipment of all manufacturers must be in accordance with these specifications and plans. Being named as a manufacturer does not eliminate their responsibility of providing equipment in compliance with the following specification section. Any deviations without sufficient evidence proving equal or superior quality shall be rejected without further review or comment.

2.02 PERFORMANCE REQUIREMENTS

A. DESIGN SUMMARY

1. Number of systems
2. Nominal drum screen basket diameter 47" (1200mm)
3. Drum Screen perforation openings 3/8" (10mm)
4. Max. hydraulic capacity per drum screen based on viscosity similar to water, GPM 880 GPM
5. Max. hydraulic capacity per drum screen (4% solids) 500 GPM
6. Max. drum screen screenings capacity 53 cubic feet per hour
7. Washer Compactor Capacity 212 cubic feet per hour
8. Location rating Class 1, Division 2

B. The septage station shall be designed to screen septic sludge that is supplied in tankers. The drum screen shall wash, transport, and discharge material into a wash and press. The wash and press shall dewater and compact material from the drum screen and discharge into screening bags. The unit shall be entirely enclosed to prevent odor nuisance.

C. The drum screen shall have 4" inflow and 8" outflow connections equipped with Class 150 ANSI/ASME B16.5 rated flanges.

D. The unit shall be provided with adequate stiffening to prevent distortion and with four height adjustable (+/- ¾ inch) legs that shall be anchored on the floor. Lifting lugs shall be provided for unloading the unit.

E. The screening perforation size noted in paragraph 2.02.A.3 shall be the clear opening of each individual perforation. Screens using bar raked media, wedge wire or mesh will not be acceptable for this project.

F. Due to the abrasive nature of septic sludge containing grit, there shall be no plastic-to-plastic or plastic-to-metal wearing surfaces in the unit.

G. All open spaces of the drum screen shall be positively cleaned via spray water.

H. The drum screen shall use a single drive for screening and conveying of the screening material. The axis of the drum screen shall have an inclination of 10 degrees.

I. The operation of the rotating basket perforated plate drum and spray bars shall be automatically initiated when the system is activated and a flow of septage is pumped to the unit. The spray bars which are mounted outside the rotating basket/drum shall flush solids from the screening basket and keep them in the base of the drum where flights welded to the interior surface of the drum shall
convey the material to the discharge point. Drum screen designs utilizing an internal screw auger and trough to collect and convey material shall not be acceptable.

J. Due to the high solids loadings in septage, the screen basket shall rotate continuously while septage is flowing to always present a clean screening surface to the flow to ensure minimum headloss and rapid cleaning of the screen.

K. The unit shall be supplied with an automatic ball valve at the inlet connection. The motorized ball valve shall be controlled by the liquid level in the outlet tank of the screen. If a certain liquid level is maintained for a certain period, the valve is closed and an alarm triggered.

L. The unit shall be able to process heavy grease loads without the need for changing any control settings or drive speeds. Systems requiring the users to change any settings between “normal” and “grease” loads shall not be acceptable.

M. To minimize odors and nuisance, the conveyance, dewatering and compaction zones shall be completely enclosed.

N. The spray wash system shall be enclosed such that spray water, aerosols or leakage do not contaminate the operating floor.

O. Wash Press Dewatered screenings shall be discharged at an elevation of ___ above the base of the channel floor.

P. The screening equipment shall produce dewatered screenings capable of passing the EPA Paint Filter Test as described in method 9095 of EPA Publication SW-486.

Q. The control system shall be designed such that the cleaning characteristics of the septage receiving system can be changed via the programmable controller. Systems which do not offer this feature will not be acceptable for this project.

R. MATERIALS

1. Unless otherwise specified in these specifications, the entire septage receiving station equipment shall be manufactured from AISI 316L austenitic stainless steel shapes (rods, angles, and channels), pipes, and sheets. All mechanical parts shall be designed to handle the forces that may be exerted on the unit during fabrication, shipping, erection, and proper operation according to the O&M manual.

2. Rollers for the bearings for the drum shall be made of polyamide PA 6.

3. The entire equipment shall be manufactured in a stainless steel only factory to prevent contamination of the stainless steel with rusty dust.

4. The equipment, after its fabrication, shall undergo a passivation (pickling) process to ensure maximum resistance to corrosion. All stainless steel components and structures shall be submersed in a chemical bath of nitric acid and hydrofluoric acid to remove any residues that may be present on the material as a result of forming, manufacture, or handling. After removal from the pickling bath, the equipment must be washed with a high-pressure wash of cold water to remove any remaining surface debris and promote the formation of an oxidized passive layer which is critical to the long life of the stainless steel. Submergence insures complete coverage. Spray on chemical treatments and glass bead blasting are specifically not acceptable due to their inability to provide complete and uniform corrosion protection.

S. ANCHOR BOLTS
1. Equipment manufacturer shall furnish all anchor bolts of ample size and strength required to securely anchor the equipment for the septage receiving station. Anchor bolts, hex nuts, and washers shall be stainless steel. Anchor bolts shall be wedge or epoxy type.

2. Anchor bolts shall be set by the contractor. Equipment shall be placed on the foundations, leveled, shimmed, bolted down, and grouted with a non-shrinking grout.

2.03 DRUM SCREEN DESIGN

A. ROTATING BASKET DRUM

1. The drum screen shall be provided with (2) two spray bars for drum surface cleaning. The control system shall be designed so that the cleaning characteristics of the screen and spray wash systems can be changed via the programmable controller. Systems which do not offer this feature will not be considered for this project.

2. The rotary perforated plate drum screen shall be designed and built to withstand static and hydraulic forces exerted by the liquid to the screen. All structural and functional parts shall be sized for the loads encountered during the screening and conveying operations. All components of the rotary perforated plate screen in contact with the septic sludge or screened solids shall be of stainless steel construction.

3. The screen basket with a length of 9' 6 2/7" (2816mm) shall be of a cylindrical shape. The perforations shall go around the entire basket drum. The width of the tank shall be 5' 3 3/5" (1615mm).

4. The rotating basket assembly shall be cleaned by two stainless steel high pressure spray bars. The screen basket shall continuously rotate in one direction.

5. The rotating basket shall be driven by a drive with pinion gear positively engaged in a chain which is fixed to the drive end basket flange. The chain shall be unable to move to ensure smooth operation of the screen drum. Screen designs utilizing a chain design that allows the chain to be slack or requires lubrication shall not be acceptable.

B. SPRAY WASH SYSTEM

1. An automatic spray wash system shall be provided for the screen and shall be constructed of 1 ½” diameter minimum piping and flexible reinforced PVC hose. The spray wash system shall be operated only while the screen basket is rotating. The spray wash system shall include one (1) solenoid valve for flow control and shall also include two (2) brass body ball valves.

2. The spray wash system shall be designed for a water supply of 30gpm (7m3/h) with a min pressure of 100psi (7 bar). The screen will be provided with a central wash water manifold which shall include a single feed connection of 1 ½". The manifold shall be designed to evenly distribute wash water to all washing points on the screen utilizing one (1) electrically operated solenoid valve.

3. An upper wash system shall be located in the inlet area over the outside of the basket drum and shall utilize a spray bar with a minimum of 8 spray nozzles.

4. A lower wash system shall be located in the outlet area over the outside of the basket of the drum and shall utilize a spray bar with a minimum of 8 spray nozzles.
5. The solenoid valve shall be operated via the programmable controller and/or manually.

6. The solenoid valve shall be 1 ½” minimum, brass body, 2-way, and designed for 110 VAC operation with an explosion-proof rating. The solenoid valve shall be normally closed and rated for up to 100 psig.

7. A 2” brass body Y-strainer shall be provided for the incoming plant water supply. The strainer shall include a removable and washable stainless steel 20-mesh (800 micron) filter element.

8. The wash systems shall be operated on an intermittent basis only. Wash systems which operate continuously will not be acceptable.

9. The solenoid valve shall be operated by the programmable logical controller. Manual operation of the solenoid valve shall also be possible from the local control station.

C. SCREEN DRIVE

1. The basket mechanism and transport screw shall be driven by a geared motor. The geared motor shall have a minimum service factor of 1.0 equivalent to an AGMA Class I rating.

2. The gear reducer shall be bolted to the RoFAS.

3. The gear reducer shall be driven by a 1,760 rev/min, 3 phase, 60 Hertz, 230/460 volt, Class 1, Division 1, Group D, inverter duty, totally-enclosed, fan-cooled motor which leads to a conduit box for outdoor operation. Motor size shall be 3 HP.

4. Belt drives, hydraulic drives or a separate upper bearing for the transport screw will not be acceptable for this project.

D. ACTUATED INLET VALVE

1. The Septage Receiving Drum Screen inlet flow shall be controlled by an electrically actuated PVC ball valve which shall be installed in the inlet piping.

2. The actuator shall be suitable for 120VAC, 1-phase operation in an explosion proof environment and have a maximum opening/closing time of 11 seconds. Actuator shall be provided with a NEMA 4X housing.

3. The actuator shall be model IQT as made by Rotork and shall be provided with an Asahi PVC ball valve.

E. FLOW METER

1. A magnetic flow meter shall be installed in the inlet piping system between the electrically actuated ball valve and the septage receiving drum screen.

2. The transmitter shall be a model Promag 10 as manufactured by Endress & Hauser with a four wire microprocessor with HART® based communication capabilities, and be suitable for 85 to 250VAC. The flow tube shall have a coil resistance of <700Ω and shall be capable of processing signals from fluids that are travelling between 0.032ft/s and 108ft/s. The transmitter shall be FM approved for a Class 1 Division 2 environment and shall be provided with a NEMA 4X housing.
2.04 WASH PRESS DESIGN SPECIFICATIONS

A. SCREENINGS WASHER BODY

1. The WAP 6 screenings washer body shall be fabricated from 5/32" (4 mm) thick AISI 316L stainless steel. The 14" (358 mm) diameter screenings washer body shall include a nominal 47-1/4” x 15-3/4” (1200 mm x 400 mm) trough opening for screenings deposit. A level mounting flange shall be provided around the trough for the transitional hopper that directs the screenings into the trough of the screenings washer. The hopper shall be fabricated from 3/32” (2.5 mm) thick stainless steel.

2. The screenings washer body shall house the shafted screw, and shall include one (1) 1” diameter wash water connections in the compaction zone, one (1) 3/8” diameter connection in the screenings trough, and shall include two (2) connections to the drain pan to flush any debris from the drainage pan.

3. The screenings washer body shall include 3/16” (5 mm) diameter perforations spaced 13/32” (10 mm) center-to-center in a vertical alignment in the washing and compaction zones to drain the excess wash water and filtrate water pressed from the screenings to the drain pan.

4. The screenings washer body shall be equipped with not less than six (6) guide bars made of Hardox 400 abrasion resistant plate. The guide bars shall be bolted from the outside of the tube for easy access and removal. The guide bars shall be at least 20” (503 mm) long and the thickness shall be not less than 13/32” (10 mm). Welded guide bars shall be not allowed.

B. SHAFTED SCREW

1. The shafted screw shall transport the screenings from the trough area (washing zone) into the compaction zone and shall force the compacted screenings out the discharge pipe. The shafted screw for the WAP 6 shall be fabricated from 1/4” (6 mm) thick AISI 316L stainless steel.

2. The screw flights shall have a minimum thickness of 13/32” (10 mm) in the trough area, a thickness of 13/32” (10 mm) in the perforated washing zone, and a thickness of 25/32” (20 mm) in the compaction zone. The outside diameter of the screw shall be 13-7/16” (341 mm) and shall include an 8” (200 mm) flight pitch in the trough area and washing zone, and a 6-3/4” (170 mm) pitch in the compaction zone.

3. Screw flights in the compaction zone shall have a Hardox 400 abrasion resistant plate welded to the stainless steel flights. The last flight of the screw shall have Tubrodur hard metal seams welded around the external surface of the flight.

4. A stainless steel backed brush with nylon bristles shall be attached to the shafted screw with stainless steel clips and fasteners for the full length of the perforated washing zone.

C. PLANT WATER MANIFOLD

1. The screenings washer shall be equipped with a manifold to provide plant water to the different washing inlet locations. The screenings washer shall be provided with not less than two (2) separate connections for injecting wash water into the screenings and two (2) connections to the drain pan underneath the wash and press body. The unit shall be designed to accept wash water from the facility’s non-potable water system, which is sourced from final plant effluent.
2. Wash water connections shall be sized and positioned by the unit manufacturer. Maximum water consumption for the unit shall be 24 gallons per minute. The water pressure range required at the connection to the unit for proper unit operation shall be 30-75 psi.

3. The main wash water supply line to the wash and press unit shall be provided with two (2) 1” diameter Burkert normally-closed solenoid valves with maximum operating pressure of 140psi. The solenoid valves shall be independently controlled by the PLC in the control panel. One solenoid valve shall supply wash water directed against the rotation of the screw flights in the inlet hopper, and into the press zone of the WAP. The second solenoid valve shall direct wash water to the drain pan beneath the screenings washer body.

D. DRAIN PAN

1. The drain pan shall be an integral part of the washer body and collect the spent wash water and filtrate water squeezed from the screenings. The drain pan shall be fabricated from 1/8” thick (3 mm) stainless steel and shall include several bolted inspection openings.

2. The drain pan shall include two (2) 3/4” threaded inlet connections for wash water from the manifold to flush the trough for cleaning purposes. A 4” (100 mm) diameter flanged drain connection shall be provided to discharge the drained water back into the channel on the downstream side of the screen.

E. DISCHARGE PIPE

1. The wash and press discharge pipe shall be made of stainless steel and shall be connected to the screenings washer body by a 14” (350 mm) diameter flange. The diameter of the straight section of the discharge pipe shall increase in size to ease the transport of the screenings. The diameter of the discharge pipe straight section shall increase from 14” to 17-3/4”. The bend fittings on the unit’s discharge pipe shall have a radius that is three times (3x) larger than the pipe diameter.

F. GEAR MOTOR DRIVE MECHANISM

1. The drive unit shall be a gear motor rated for continuous duty and shall be selected to match the requirements of the particular screen. The drive motor shall be a 7.5 HP, totally enclosed unit designed for application in a Class 1, Division 1 area. The motor shall be a constant speed unit rotating at 1760 rpm, and shall be powered by 230/460 VAC, 60 Hz, 3 phase power.

2. The drive unit shall be direct coupled to the screening wash and press drive shaft through the gear box. The gear box housing shall be constructed from ASTM A-48, Class 30 cast iron.

3. The gear box shall be designed for AGMA Class II, 24 hour duty.

G. SCREENINGS BAGGER UNIT

1. A Paxxo Longofill continuous bagging system shall be provided to abate odors and to seal dewatered screenings to prevent any direct contact. The discharge bagging system shall provide a clean, odor-free means of collecting and containing the material discharged from the screenings equipment.

2. The bagging system components shall be attached to the screenings discharge. An accordion-folded plastic Paxxo Longopac cassette bag shall be fitted to the end of the bagging system and will collect any discharged material. The end of the cassette bag will be tied in a knot. When the operator decides that the cassette bag is full, the cassette bag shall
be cut and the exposed ends tied in knots.

3. A Longofill stainless steel adapter flange and a Paxxo Longofill ABS plastic cassette bag holder shall be utilized to mount for the screenings discharge. The adapter flange shall be fitted to the discharge chute such that it is positioned as close to horizontal as possible. The plastic holder shall be attached to the stainless steel adapter and shall hold the continuous cassette bag.

4. The adapter flange shall be stainless steel. The holder shall be of ABS plastic and shall consist of two parts, a tube and brim, which shall be held together by a stainless steel ring. The cassette bag shall be 230 ft (70m) long, non-porous, three-ply, co-extruded polyethylene with a min thickness of 1.8 mil and a dart drop of not less than 1.80 lbs (820 g).

PART 3: CONTROLS

3.01 LOCAL CONTROL STATIONS

A. Each drum screen shall be provided with NEMA 7, Class 1 Division 1, Cast Aluminum Local Control Station. Each Screen Control Station Shall be equipped with the following devices:

1. System E-Stop
2. Screen HAND-OFF-AUTO
3. Screen FOR-OFF-REV
4. Spray Bar HAND-OFF-AUTO

B. Each wash press shall be provided with NEMA 7, Class 1 Division 1, Cast Aluminum Local Control Station. Each Press Control Station Shall be equipped with the following devices:

1. System E-Stop
2. Press HAND-OFF-AUTO
3. Press FOR-OFF-REV
4. Press Zone Wash HAND-OFF-AUTO
5. Pan Wash HAND-OFF-AUTO

3.02 CONTROL PANEL

A. A single main control panel shall be furnished with a lockable NEMA 4X corrosion-resistant 316 stainless steel, enclosure suitable for installation in a NON-Classified area.

B. Controls panel shall be made by a U.L. listed company and shall bear a U.L. label.

C. Control panel wiring shall be color coded, neatly cabled and supported in non-flammable wiring tracks. Wiring shall be minimum 14 gauge MTW stranded wire.

D. Control panel shall contain all power and control devices necessary for the proper function of the complete septage receiving system and shall include the following:

1. 600-Volt rated main circuit breaker disconnect with lockable handle
2. 480 – 120 Volt control power transformer
3. Transient voltage surge supressor TVSS, 120 V AC single phase
4. Panel heater with thermostat (OPTION)
5. Reversible Drum Screen VFD, Square D Altivar 312 or equal
6. Reversing Motor Starter for the Wash Press, type IEC with Circuit Breaker Protection
7. Wash Press Current Monitoring Relay
8. White pilot light for “Control Power” indication
10. Red “Fault” pilot light for each Motor
11. Digital inputs for the following:
   a. Inlet valve open
   b. Maximum water level
12. Remote dry contact outputs for the following:
   a. Drum Screen running
   b. Drum Screen fault
   c. Drum Screen high level
   d. Press Running
   e. Press Fault
   f. High water level
13. Push-to-Stop/Pull-to Run emergency stop maintained push button with lockout
14. Alarm silence and reset push buttons
15. Control relays, wiring and circuitry required to implement the control logic
16. Programmable logic controller (PLC), Allen Bradley Micrologix 1400
17. Operator interface (OIU), Allen Bradley PanelView C400
18. Plastic Nameplates

3.03 HAULER ACCESS STATION (OPTIONAL)

A. KEYPAD ACCESS AND COMPUTER SYSTEM

1. The manufacturer shall provide a secured access station that will identify a waste hauler and be configurable to interface with associated equipment (doors, gates, valves, sampler, screen & washer, etc.).

2. The Hauler Access station shall be an integral part of a comprehensive fully-managed septage receiving system, including the necessary software as described later in this specification.

3. Hauler Access shall be established using a keypad, magnetic card, a non-insertion proximity card or long-range proximity reader. All access stations shall receive configuration and security access data from the software described in this specification.

4. The Hauler Access Station shall be constructed with an outer door that can be closed to enable a wash down of the area without damaging the internal mounted devices. An enclosure with a rating less than Type 4X will not be acceptable.

5. A Hauler shall access the station by opening the door to the Type 4X enclosure and enter a Truck ID using the keypad or by using an assigned card. Card types shall be either magnetic-striped, non-insertion type card (proximity device).

6. A single card option for accessing the facility’s front gate and hauler station shall be possible if required by the facility.

7. The Hauler Access Station shall be provided with a daylight visible display and outdoor-rated, robust keypad with integral 2-track card reader. The display shall prompt the hauler with log-on instruction and display responsive messages that allow the facility to leave the station unattended.

8. The Hauler Access Station shall be provided with a receipt printer that will quickly print and cut the receipt. An integral light shall inform the hauler that receipt is printed. A
journal copy of transactions shall be stored and printed upon request. A low paper alarm shall be registered with the transaction and viewed on PortAlogic.

9. The Hauler Access Station shall continue to function normally without a network connection to the office. All data shall be stored in non-volatile memory. If a network connection is established, all transaction data shall be automatically synchronized and securely stored to an IT managed SQL database.

10. The Hauler Access Station shall be maintained without requiring Arc Flash protective clothing. Changing paper shall be possible by all personnel. Motor starters or other high voltage devices must be located in a separate control panel. Control circuits greater than 24VDC shall not be accepted.

11. The hauler access station shall be provided with the following components:

1. Enclosure
   a. NEMA 4X Stainless Steel
   b. Internal Swing-out door, also Stainless Steel
   c. Lockable Full-Grip Handle with 3-Point Latch
   d. Drip Shield
   e. Available with optional sun shield and pedestal
   f. Thermally protected for severe cold weather installations
   g. Instruction decals

2. Access Keypad / Card Reader
   a. Secure, robust, and outdoor rated
   b. Clear, backlit LCD display, visible in all levels of light.
   c. Compliant with local and global security standards
   d. Advanced tamper-proof design

3. Programmable logic controller, PLC, including;
   a. Ethernet connection to PortAlogic software.
   b. Configurable spare analog and digital I/O
   c. Printer Interface
   d. Detachable terminals
   e. Non-volatile memory

4. Printer Terminal
   a. Compact Thermal Printer
   b. Exclusive anti-paper-jam system
   c. Integral Autocutter
   d. Backlit receipt dispenser
   e. Printed receipt for each user
   f. RS232 and USB data port
   g. LED Illuminated paper chute

5. Pilot Devices
   a. Heavy Duty, 30mm. AB Type 800H or equal.
   b. 2-Position Switch with Done-Start Legend
   c. Green Light with System Ready Legend

6. 24VDC power supply

7. Ethernet switch (non-managed)

B. MANAGEMENT SOFTWARE
1. The Septage Receiving System shall include the necessary software to allow a local or remote networked PC to seamlessly interface with the hauler station/s using an Ethernet connection.

2. The software shall allow the facility to connect and exchange data to one or more hauler stations, located at one or more receiving sites.

3. The software shall be used to configure the station’s access device and enable/disable hauler access codes.

4. The software shall be used to configure the devices that will measure the volume, pH and sampler if installed. Other analog devices, if installed, will also be configured.

5. The software shall monitor each station and automatically upload the hauler’s transaction data.

6. The data shall be stored into a secure SQL database. The data shall include Site ID, Station ID and Ticket Number, Hauler ID, Date and Time of Transaction, Volume unloaded, pH, Waste ID, Alarm ID, Sample, and Volume Remaining, plus five (5) additional user-defined data fields.

7. The software shall be installed on any site owned PC using Windows XP Pro OS with a network card configured to communicate with the hauler access station/s

C. CUSTOMER AND TRUCK FEATURES:

1. The software shall allow the facility to create a list of customers that will be billed for the station/s use. A user-friendly interface shall be provided for entering customer details and account number. The software shall not limit the facility as to the number of customer accounts that can be created.

2. The software shall allow the facility to create multiple truck accounts and link these accounts to the customer (owner of truck). The software shall not limit the facility as to the number of trucks that can be assigned to each customer. A User-friendly interface shall be provided to enter the Hauler ID, PIN, and other details regarding the truck, including capacity, weight, and vehicle identification.

3. The customer shall be provided with a Hauler ID and 4-Digit PIN for each truck that will access the Receiving Station. PIN assignment can be unique per owned truck or common to all owned trucks, depending on facility and customer preference. Software shall auto-generate a PIN or allow manual entry of a PIN.

4. The software shall include an Overview Screen, divided into sections that will display the Transaction Log, Customers, Truck Status, Customer Balances and quick-link to Reports. Data views shall be configurable to show customer and truck activity using built-in sorting tools.

5. The software shall allow the facility to enable or disable a truck’s access privilege. Once disabled, a Hauler’s access will be immediately denied at all stations and at all sites. A message shall be displayed to inform the hauler to contact the office.

6. The software shall have multiple pre-formatted reports that can be printed to a networked printer, emailed or exported using common file formats. As a minimum, the software shall include reports to show Activity with daily totals, Statements, and Customer and Truck
usage. Systems that only allow offer manual file retrieval from the station or manipulation of .csv files are not acceptable.

7. User-friendly interface screens shall be included for the facility to enter waste types and rates, alarm identification, station name and location. This data shall be used in both the basic and advanced features of the system management.

D. WASTE TYPE FEATURES:

1. The software shall allow the facility to define a list of allowed waste types and the associated rates that will be charged per 1000 units unloaded. Units can be user-defined (Gallons, liters, etc.).

2. The hauler will be prompted during log-on to identify the waste type that will be unloaded. The waste type entered will be part of the transaction data sent to PortALogic.

3. The software shall total the truck volume and calculate the total cost for the waste type entered by the hauler. Office will be able to edit this waste type if hauler entered an incorrect value.

4. The hauler station shall have the option to divert the waste to a special holding tank if required by the facility.

5. The hauler station shall have the option to set equipment operational parameters to process thicker waste in shorter time, decreasing the hauler's total unloading time.

6. A rate structure for waste types shall allow the facility to charge rates relative to the cost of treatment. Waste types shall also allow the facility to define rates that are different for the same waste, i.e., in-county vs. out-of-county haulers.

7. The software shall include reports for the facility to transactions by waste type.

E. ALARM & STATUS FEATURES:

1. The software shall allow the facility to monitor the station status, including the truck using the station, total flow, waste type, valve status, equipment fault, and additional user-defined variables.

2. The software shall allow the facility to monitor alarms that make the station un-useable or that prevent a hauler from unloading. Alarms shall be stored in the transaction details. Alarms include; E-Stop pressed, Printer Low Paper, Equipment Fault, storage tank High Level, plus other alarms that can be user-defined.

F. BILLING & PAYMENT FEATURES:

1. The facility shall be able to use the features of this software to substantiate the data recorded for each transaction and accurately calculate the total cost on a per customer basis.

2. The facility shall have the option to use the software to create a billing statement or use the tools export data to the primary accounting software. Data can also be exported to Adobe, Crystal Reports, Excel or Word.
3. The software shall allow the facility to manage each customer on a debit or credit basis. The customer is required to pay in advance or the customer can pay after usage of the station.

4. The software shall debit the account balance automatically and auto-deactivate the truck’s access privilege should the customer’s balance drops below a minimum. The remaining capacity balance is updated and printed on the hauler’s receipt.

5. The software shall allow the facility to bill on a truck capacity basis, a metered basis (flow-meter or scale), or manually entered volume basis. This feature shall be configured with PortALogic.

6. The software shall allow the facility to enter payments if required. The total balance shall automatically recalculate once a payment is applied. A customer’s account that is deactivated shall be automatically activated once money is received.

G. OTHER FEATURES:

1. The software shall allow the facility to define the Station’s Operating Time Schedule. Each day shall be configured with Open and Close times. If closed, station will prompt the hauler that the station is CLOSED.

2. The software shall allow the facility to periodically initiate a vacuum sampler (by others). Samples can be taken automatically each trip or randomly for each truck. Transaction data will show which load was sampled.

PART 4: EXECUTION

4.01 DELIVERY, STORAGE, AND HANDLING OF EQUIPMENT

A. All equipment shall be shipped and delivered fully assembled, except where partial disassembly is required in order to conform to transportation regulations or for the protection of components.

B. The Contractor shall be responsible for unloading of the machinery and shall have equipment on-site available at the time of delivery permitting proper hoisting of the equipment.

4.02 FIELD PREPARATION AND PAINTING

A. CONTRACTOR shall touch-up all shipping damage to the paint and stainless steel as soon as the equipment arrives on the job site.

B. CONTRACTOR shall supply paint for field touch-up and field painting.

C. CONTRACTOR shall finish paint electrical motors, speed reducers, and other self-contained or enclosed components with oil-resistance enamel.

D. CONTRACTOR shall coat all stainless steel bolts and nut threads with a non-seizing compound prior to final assembly.

4.03 INSTALLATION, START-UP AND OPERATOR TRAINING
A. Contractor shall verify all dimensions in the field to ensure compliance of equipment dimensions with the drawings. Contractor shall notify Engineer of significant deviations.

B. Installation of the equipment shall be in strict accordance with the contract documents and the manufacturer’s instructions and shop drawings. Manufacturer shall supply anchor bolts for the equipment. Contractors shall install the anchor bolts in accordance with the manufacturer’s recommendations.

C. Manufacturer shall furnish the services of a factory-trained Service Engineer for one (1) trip including four (4) days to inspect the installation, observe start up, and provide operator training.
   1. Equipment shall not be energized, or “bumped” to check the electrical connection for motor rotation without the Service Engineer present.
   2. The Service Engineer shall make all necessary adjustments and settings to the controls.
   3. The Service Engineer shall demonstrate proper operation of the entire unit.

End of Section
Project: Charleston, SC

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>UNIT</th>
<th>DESCRIPTION</th>
<th>UNIT PRICE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>EA</td>
<td>VAUGHAN MODEL V4KR-080 VERTICAL WETWELL RECIRCULATING CHOPPER PUMP 7 FEET LONG CONSISTING OF:</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- CASING, cast ductile iron.</td>
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<td></td>
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<td></td>
<td>- IMPELLER, CUTTER BAR, UPPER CUTTER AND CUTTER NUT, cast steel, heat treated to minimum 60 Rockwell C Hardness. Impeller dynamically balanced.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- DISCHARGE FLANGE, 4&quot; 150 LB ANSI rated.</td>
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<tr>
<td></td>
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<td></td>
<td>- RECIRCULATION VALVE ASSEMBLY, cast ductile iron with 316 stainless steel valve disk, manually operated for recirculation or discharge. Includes reach rods through deck plate with handles.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>- RECIRCULATION NOZZLE, 1018 steel, includes nozzle deflector (adjustable 180° horizontally and 45° vertically).</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- BEARINGS, oil bath lubricated ball type except top bearings are grease packed.</td>
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<td></td>
<td></td>
<td></td>
<td>- MECHANICAL SEAL, cartridge type with SC faces, as manufactured by Vaughan.</td>
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<td>- ELASTOMERS, BUNA N</td>
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<td></td>
<td></td>
<td></td>
<td>- AUTOMATIC OIL LEVEL MONITOR, 316 Stainless steel reservoir with 110 volt switch and relay.</td>
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<td></td>
<td></td>
<td></td>
<td>- COUPLING, elastomeric type by TB Woods.</td>
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<td></td>
<td>- MOTOR MOUNT, 1018 steel, piloted for &quot;C&quot; flanged mounted motor.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- MOUNTING BASE, 1018 steel.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- SUBMITTAL FINISH: Sandblasted and single coat of Tnemec 27wb primer (5-8 MDFT) and finish coat of Tnemec 27WB Epoxy (5-8 MDFT). (Except Motor)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>EA</td>
<td>ELECTRIC MOTOR CONSISTING OF:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- DRIVE, 10 HP, 1200 RPM, 460/3/60, 1.15 SF, &quot;C&quot; flanged TEFC electric motor.</td>
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</tr>
</tbody>
</table>

“First and Only Chopper Pump – Worldwide”

Mike Dillard | WC Equipment Sales |
| www.wcequipment.com | 4324 Brogdon Exchange, Suite 200, Suwanee, GA 30024 |
| + 1 678.730.0997 o | + 1 770.614.5992 f | mdillard@wcequipment.com
ITEM | QTY | UNIT | DESCRIPTION | UNIT PRICE | TOTAL
--- | --- | --- | --- | --- | ---
3 | 1 | | OP SERVICES CONSISTING OF: | |
- FACTORY PERFORMANCE TESTING
- FACTORY SUBMITTALS AND O&M MANUALS
- FREIGHT TO THE JOB SITE
- START-UP

TOTAL BUDGET COST | $ 19,510

Freight quotes are for informational purposes only and is not a guarantee of the final shipping charge. Shipping charges are not finalized until the equipment leaves Vaughan's warehouse. Partial shipments are subject to additional freight charges.

PUMP PERFORMANCE: 500 GPM @ 10 FT. TDH
APPLICATION: Septage Receiving
INDUSTRY: Municipal

____________________________________
Mike Dillard WC Equipment

“First and Only Chopper Pump – Worldwide”

Mike Dillard | WC Equipment Sales | www.wcequipment.com | 4324 Brogdon Exchange, Suite 200, Suwanee, GA 30024 | +1 678.730.0997 o +1 770.614.5992 f mdillard@wcequipment.com
**Project: Charleston, SC**

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</tr>
</thead>
</table>

**PRODUCTION TIME:** ESTIMATED 6-8 WEEKS SHIPMENT AFTER RECEIPT OF APPROVED SUBMITTALS OR RELEASE TO PRODUCTION AND EXECUTED PURCHASE ORDER. ESTIMATED SHIP DATES ARE SUBJECT TO CHANGE DEPENDENT ON MOTOR AVAILABILITY. VAUGHAN CO. WILL ARRANGE SHIPMENT UPON THE RECEIPT OF APPROVED FACTORY TESTS, IF APPLICABLE.

**TERMS:** NET 30 DAYS, CONTINGENT ON CREDIT APPROVAL

**EXPIRATION:** QUOTATION VALID FOR 60 DAYS
GENERAL: The Terms & Conditions herein established by Vaughan Co., Inc. ("us", "we", "our") as may be amended by us from time to time ("Terms and Conditions") apply to all dealings with our potential and actual customers ("you" and "your"), whether made by you or us, for any solicitation, submission, inquiry, offer, request or arrangement (a "Communication") or sale by us with respect to goods we sell ("Product(s)").

SCOPE OF SUPPLY: Scope of supply will be limited to accepted quotation.

ACCEPTANCE: No Communication is binding on us unless we actually receive it and we agree, either in writing or by delivery of Product(s) identified in such Communication, to accept it as an order for Product(s) (an "Accepted Order"). Any sample provided by us is not part of an Accepted Order.

NO CANCELLATION: Accepted Orders cannot be cancelled or modified, in whole or in part, without our prior written consent, which consent may be withheld or subject to conditions and reasonable charges we may impose.

PRICE INCREASE: Price of Product(s) is subject to increase if equipment is not shipped within twelve months from the date of the purchase order.

TAXES: All prices are subject to all applicable sales and use taxes and any other taxes now or hereafter imposed and/or levied by any governmental authority with respect to the sale of the Product(s) ("Applicable Taxes"). Unless we agree to an express provision to the contrary, Applicable Taxes will be added to the price you pay. Our failure to charge or collect Applicable Taxes when due shall not relieve you of your obligation for its payment. Regardless of any other payment terms, Applicable Taxes are due net 30 days from the invoice date.

PAYMENT TERMS: Terms of sale will be shown on each invoice, and it is agreed that invoices will be paid in full when due. If payment in full on any invoice is not received when due, or if your credit worthiness is deemed unsatisfactory by us at any time, we may take, without incurring any liability, one or more of the following actions: (a) impose a service charge at the rate that is the lesser of (i) 1.5% per month or (ii) the maximum rate allowed by applicable law, on any amount past due commencing from the date of such invoice, (b) modify or accelerate payments terms, (c) withhold delivery of Product(s) under any Accepted Order not yet shipped and/or delay, recall or reclaim shipments of Product(s) en route to you or delivered until arrangements satisfactory to us are made to secure payment for any outstanding invoice and for all open Accepted Orders and/or (d) file a lien for any unpaid labor or material.

DATES OF DELIVERY: Delivery dates are approximate and subject to change based upon Product(s) availability, production schedules, and other prevailing conditions. Shipment date is contingent upon the receipt of approved submittals. You must accept delivery after approval of submittals and production time or issue us a change to the Accepted Order that must be accepted by us in writing.

LONG TERM STORAGE: We will hold Product(s) in long term storage contingent upon payment of full purchase order price less retainage. Long term storage duration, fees, and any other considerations will be evaluated on a case by case basis.

YOUR ACCEPTANCE OF PRODUCT(S): You are responsible to promptly inspect Product(s) delivered and notify us within five (5) calendar days following receipt of the Product(s) for which a claim is filed, of any shortages or non-conformance of the Product(s) with the Accepted Order.

RETURNS: Product(s) may not be returned for any reason without authorization by us. Please refer to the “Returned Goods Authorization Policy” for further information on returns.

WARRANTY: Vaughan Co., Inc. warrants to the original purchaser/end user all pumps and pump parts manufactured by Vaughan Co. to be free from defects in workmanship or material for a period of one (1) year from date of startup or eighteen (18) months from the date of shipment from Vaughan Co., whichever occurs sooner. If during said warranty period, any pump or pump parts manufactured by Vaughan Co. prove to be defective in workmanship or material under normal use and service, and if such pump or pump parts are returned to Vaughan Co. a factory at Times, WA, or to a Vaughan authorized Service Facility, transportation charges prepaid, and if the pump or pump parts are found to be defective in workmanship or material, they will be replaced or repaired by Vaughan Co. free of charge. Products repaired or replaced from the Vaughan Co. factory or a Vaughan authorized Service Facility under this warranty will be returned freight prepaid. Vaughan Co. shall not be responsible for the cost of labor for pump or part removal and/or re-installation. All warranty claims must be submitted in writing to Vaughan Co. not later than thirty (30) days after warranty breach occurrence. The original warranty length shall not be extended with respect to pumps or parts repaired or replaced by Vaughan Co. under this warranty. This Warranty is voided as to pumps or parts repaired/replaced by other than Vaughan Co. or its duly authorized representatives. Vaughan Co. shall not be liable for consequential damages of any kind and the purchaser by acceptance of delivery assumes all liability for the consequences of the use or misuse of Vaughan Co. products by the purchaser, its employees or others. Vaughan Co. will not be held responsible for travel expenses, rented equipment, outside contractor’s fees, or unauthorized repair service or parts. This warranty shall not apply to any part of product or part of product which has been subjected to misuse, accident, negligence, operated in the damaged parts of the published pump curves, used in a manner contrary to Vaughan’s printed instructions or damaged due to a defective power supply, improper electrical protection or faulty installation, maintenance, or repair. Wear caused by pumping abrasive or corrosive fluids or by cavitation is not covered under this warranty. Equipment and accessories purchased by Vaughan Co. from outside sources which are incorporated into any Vaughan pump or any pump part are warranted only to the extent of and by the original manufacturer’s or warranty, if any, which warranty, if appropriate, will be assigned by Vaughan Co. to the purchaser/end user. THIS IS VAUGHAN CO.’S SOLE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHICH ARE HEREBY EXCLUDED INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Vaughan Co. neither assumes, nor authorizes anyone or company to assume for it, any other obligation in connection with the sale of its equipment with the exception of a valid Vaughan “Performance Guarantee” or “Extended Warranty”, if applicable. Any other enlargement or modification of this warranty by a representative or other selling agent shall not be legally binding on Vaughan Co.

RETAINAGE: Retainage, if applicable, is limited to 5% of the total Accepted Order price less any applicable taxes and is due (a) net 60 days after start up or (b) net 10 days upon owners acceptance, not to exceed 120 days from the invoice date.

BACK CHARGES: You shall not charge us back charges without first receiving written approval from us.

COLLECTION CHARGES: You shall pay all costs and expenses, including without limitation reasonable attorneys fees and administrative charges, we incur in endeavoring to protect our rights arising out of your failure to perform your obligations to us, including without limitation any attempt to collect any amount you owe us.

EAR COMPLIANCE: If Product(s) are exported by us, we provide the following statement: “These commodities, technology or software were exported from the United States in accordance with the export Administration Regulations. Diversion contrary to U.S. law is prohibited.”

GOVERNING LAW: The transactions between you and us are made in Washington State, shall be governed by the laws of Washington State, and you agree to submit exclusively to jurisdiction and venue of such state with respect to any dispute arising out of any transaction between you and us. YOU AND WE KNOWINGLY, VOLUNTARILY AND INTENTIONALLY WAIVE THE RIGHT TO TRIAL BY JURY IN ANY ACTION OR PROCEEDING ARISING OUT OF ANY SUCH DISPUTE.

NO RIGHT OF SET-OFF: Each Accepted Order constitutes a separate and distinct contract when accepted by us and you may not withhold payment for an invoice or offset same, in whole or in part, against sums you claim are due you by us with respect to another Accepted Order, invoice or for any other cause or reason.

INDEMNITY CLAUSE: To the extent that conditions, acts, activities or conduct involve the contributory negligence or misconduct of you or other third parties, liability will be apportioned between the parties according to comparative fault.

OUR RIGHTS ARE NOT EXCLUSIVE: Our rights hereunder are in addition to and not in lieu of any other rights and remedies available to us at law or in equity.

NOTICES: All notices of claims or disputes given by either you or us with respect to any Communication, Accepted Order or these Terms & conditions shall be in writing and sent by (a) first class mail with a copy by certified mail, return receipt requested, postage pre-paid, or (b) overnight delivery service, charges prepaid, and address as follows: (i) if for us, to our address to which a Communications was sent or an Accepted Order was placed, and (ii) if to you, at your address last known to us. Notice will be effective the first business day after notice is sent.

NO OTHER TERMS OR CONDITIONS: No Communication is binding on us unless we actually receive it and we agree, either in writing or by delivery of Product(s) identified in such Communication, to accept it as an order for Product(s) (an “Accepted Order”). Any sample provided by us is not part of an Accepted Order.

MISCELLANEOUS: No waiver of any rights or remedies shall be deemed a waiver on us unless set forth in a written waiver signed by us. We do not give up any of our rights or remedies if we fail or delay in seeking a remedy or if we accept a payment while there is a breach by you. Any such waiver, delay or failure by us on one occasion shall not be deemed a waiver by us of any future default by you or of any future right or remedy available to us. The Section, Paragraph and other heading in these Terms & Conditions are for convenience of reference only, and shall not limit or otherwise affect the meaning of any provision contained in these Terms and Conditions. The invalidity of enforceability of any of these Terms and Conditions shall in no way effect the validity or enforceability of any other provision.
NCSD SEPTAGE STATION

NORTH CHARLESTON, SOUTH CAROLINA

FOR

NORTH CHARLESTON SEWER DISTRICT
7225 STALL ROAD
NORTH CHARLESTON, SC 29419
PHONE No. (843) 764-3072

MARCH 2020

VICINITY MAP

HUSSEY GAY BELL
Established 1958

SCHEDULE OF DRAWINGS
NOTE: ALL STAINLESS STEEL SHALL BE OF 316 TYPE.
ELECTRICAL LEGEND

1. BOX DRAWINGS "X" indicates a square opening in the sheet metal, and "O" indicates a round opening.
2. WIRE SIZE: 1/4" for 1 AWG, 3/8" for 2 AWG, and 1" for 3 AWG.
3. TERMINAL SIZE: 1/4" for 1/2" terminal, 3/8" for 1" terminal, and 1" for 1 1/2" terminal.
4. EARTH TERMINAL: Painted black, and "O" indicates an earth terminal.
5. EARTH TIE: Painted red, and "O" indicates an earth tie.
6. EARTH CONDUIT: Painted blue, and "O" indicates an earth conduit.
7. EARTH BARRIER: Painted green, and "O" indicates an earth barrier.
8. EARTH PLATE: Painted yellow, and "O" indicates an earth plate.
9. EARTH GROUND: Painted gray, and "O" indicates an earth ground.
10. EARTH MAINTENANCE: Painted white, and "O" indicates an earth maintenance.

GENERAL ELECTRICAL NOTES

1. CONTRACTOR'S DRAWINGS ARE FOR INFORMATION ONLY AND ARE NOT SUBJECT TO CHANGE.
2. VERTICAL ELEVATIONS ARE SHOWN AND ARE SUBJECT TO CHANGE.
3. MATERIALS LISTED ARE ONLY A SUGGESTION AND ARE SUBJECT TO CHANGE.
4. ALL DRAWINGS ARE SUBJECT TO CHANGE AND ARE NOT A SUBSTITUTE FOR THE CONTRACTUAL AGREEMENT.
5. DRAWINGS MAY NOT BE REPRODUCED IN ANY FORM WITHOUT WRITTEN PERMISSION.
6. ALL RIGHTS RESERVED.

HOWARD ENGINEERING
ELECTRICAL ENGINEERS
MAKETTA, SOUTH CAROLINA

E1

3-27-20