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### SECTION II – GENERAL CONDITIONS

SEE CITY WEBPAGE


### SECTION III – TECHNICAL SPECIFICATIONS
SECTION I

BIDS, AGREEMENTS, AND NOTICES
BID ADVERTISEMENT/INVITATION TO BID

November 28th, 2018
Project Title: Corban Avenue Pump Station Rehabilitation
Project No. 2018-2385 (Re-advertisement)

Project Description: The Corban Avenue Pump Station Rehabilitation project generally consists of the replacement of two (2) existing 15 HP horizontal split case pumps and motors with new 40 HP pumps and motors, adjustments to existing suction and discharge piping related to pump replacements, replacement of existing motor control center, installation of two (2) new variable frequency drives for new pumps (provided by others), and installation of a new exterior portable generator connection.

Sealed Bids will be received by the City of Concord (Owner) at the address below. Please submit notarized bids in a sealed envelope by the bid opening time and date. All Bids must be in accordance with the Bidding Documents on file with the City of Concord Engineering Department. Bidders must be licensed contractors in the State of North Carolina. Bids will be received on a unit price basis. A Bid Bond must accompany each bid. The Successful Bidder will be required to furnish a Construction Performance Bond and a Construction Payment Bond as security for the faithful performance and the payment of all bills and obligations arising from the performance of the Contract. Contractor and all Subcontractors will be required to conform to the labor standards set forth in the Contract Documents. Owner reserves the right to reject any or all Bids, including without limitation the rights to reject any or all nonconforming, nonresponsive, unbalanced, or conditional Bids, and will award to lowest responsible Bidder taking into consideration quality, performance, and time specified in Bid Form for performance of Work. Owner also reserves the right to waive informalities.

Engineer: Christopher Rosenboom, PE
Project Manager
McKim & Creed, Inc.
8020 Tower Point Drive
Charlotte, NC 28227

Contractors wishing to bid on this project must register to bid by sending an email to Carolina Garcia Zaragoza, P.E. at gzaragozac@concordnc.gov. Registration for bidding requires the name of the company, physical address, email address, and telephone number. All communication regarding this bid will be done through email.

Technical questions: Contact Chris Rosenboom, P.E., (crosenboom@mckimcreed.com) 704.945.3379

Bid Due Date: December 12th, 2018 at 2:00 PM
Location: City of Concord, Alfred M. Brown Operations Center
635 Alfred Brown, Jr. Court SW
Concord, NC 28026
(See attached map/directions)
Directions from Charlotte

- Take I-77 north to I-85 north from Charlotte to Concord.
- From I-85 north, take exit 49 to the right towards Lowe’s Motor Speedway.
- At the Lowe’s Motor Speedway, turn left onto Highway 29 (Concord Pkwy) north.
- Keep going north while you pass the Wal-Mart shopping center on your right.
- Turn right at the light at the Chevrolet dealership onto Cabarrus Avenue.
- Turn right at the next traffic light at the Walgreens onto Hwy 601 South (bypass).
- (Hwy 601 S is also Warren C. Coleman Boulevard).
- Go straight through two traffic lights at Old Charlotte Road and Wilshire Avenue.
- Pass the Bi-Lo shopping center on your left.
- Turn right at the next traffic light at Manor Avenue (blue & white sign on right for the City of Concord Alfred M. Brown Operations Center).
- You will be on the entrance road into our complex.
- Follow signs to the left to Visitor Parking.
- Proceed to the front desk at the Administration Building and sign in with the receptionist.
INSTRUCTIONS TO BIDDERS

1. DEFINED TERMS. Terms used in these Instructions to Bidders are meanings assigned to them in the General Conditions and the Supplementary Conditions. An additional term is defined as follows:

Successful Bidder - The lowest, qualified, responsible, and responsive Bidder to whom Owner (on the basis of Owner's evaluation as herein provided) makes an award.

2. COPIES OF BID DOCUMENTS. Bid Documents may be obtained from the Owner via the link below for the City of Concord’s website.

Complete set of Bid Documents Charge
Free download

http://www.concordnc.gov/Departments/Finance/Purchasing/RFPs-and-Bids

Partial sets of Bid Documents will not be issued in response to requests by subject matter.

Complete sets of Bid Documents must be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misrepresentations resulting from the use of incomplete sets of Quoting Documents.

Owner and Engineer, in making copies of Quoting Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

3. QUALIFICATIONS OF BIDDERS. To demonstrate qualifications to perform the Work, Bidder may be required to submit written evidence on financial data, previous experience, present commitments, and other such data as may be requested by Owner or Engineer. Each Bid must contain evidence of Bidder’s qualification to do business in the state where the Project is located, or Bidder must agree to obtain such qualification prior to award of the Contract.

4. EXAMINATION OF CONTRACT DOCUMENTS AND SITE. It is the responsibility of each Bidder, before submitting a Bid, to (a) thoroughly examine the Contract Documents, (b) visit the site to become familiar with local conditions that may affect cost, progress, performance, or furnishing of the Work, (c) consider federal, state, and local laws and regulations that may affect cost, progress, performance, or furnishing of the Work, (d) study and carefully correlate Bidder’s observations with the Contract Documents, and (e) notify Engineer of all conflicts, errors, or discrepancies discovered by Bidder in the Contract Documents.

4.02. Underground Facilities. Information and data reflected in the Contract Documents with respect to underground facilities at or contiguous to the site are based upon information and data furnished to Owner and Engineer by owners of such underground facilities or others, and Owner and Engineer disclaim responsibility for the accuracy or completeness thereof unless it is expressly provided otherwise in the Supplementary Conditions.

4.03. Additional Information. Before submitting a Bid, each Bidder will, at Bidder’s own expense, make or obtain any additional examinations, investigations, explorations, tests, and studies and obtain any additional information and data which pertain to the physical conditions (surface, subsurface, and underground facilities, as applicable) at or contiguous to the site or otherwise which may affect cost, progress, performance, or furnishing of the Work and which Bidder deems necessary to determine its Bid for performing and furnishing the Work in accordance with the time, price, and other terms and conditions of the Contract Documents.
Owner will provide Bidders with access to the site to conduct such investigations prior to the submission of a Bid.

4.04. **Easements.** The lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and other lands designated for use by Contractor in performing the Work are identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by Contractor. Easements for permanent structures or permanent changes in existing structures are to be obtained and paid for by Owner unless otherwise specified in the Contract Documents.

4.05. **Unit Price Contracts.** Bidders must satisfy themselves of the accuracy of the estimated quantities in the Bid schedule by examination of the site and a review of the drawings and the specifications, including the addenda. After Bids have been submitted, the Bidder shall not assert that there was a misunderstanding concerning the quantities of work or the nature of the work to be done.

4.06. **Bidder’s Representation.** The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement concerning examination of the Contract Documents and the site, that without exception the Bid is premised upon performing and furnishing the Work required by the Contract Documents, and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

5. **INTERPRETATIONS AND ADDENDA.** All questions about the meaning or intent of the Quoting Documents and the Contract Documents shall be submitted to Owner in writing. Interpretations or clarifications considered necessary by Owner in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Engineer as having received the Quoting Documents. Questions received less than 10 days prior to the date for opening of Bids may not be answered. Only answers issued by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

6. **BID SECURITY.** Each Proposal must be accompanied by a deposit equal to 5% of the net price bid. This deposit may consist of cash, or a Cashier's Check issued by, or a Certified Check drawn on a Bank or Trust Company authorized to do business in North Carolina, or on a Bank insured by the Federal Deposit Insurance Corporation, or a U.S. Money Order, payable to the City of Concord or 5% Bid Bond in the form required by G.S. 143-129 as amended, issued by an Insurance Company authorized to do business in North Carolina, said deposit to be retained in the event of failure of the successful bidder to execute a formal contract within ten (10) days after award or to give satisfactory surety required.

The Bid security of the Successful Bidder (if so required) will be retained until such Bidder has executed the Agreement, furnished the required contract security (if so required), and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Agreement and furnish the required contract security within the number of days set forth in the Bid Form, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security (if so required) of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the Agreement or the day after the last day the Bid remain subject to acceptance as set forth in the Bid Form, whereupon Bid security furnished by such Bidders will be returned. Bid security accompanying Bid which are deemed by Owner to be noncompetitive will be returned within 7 days after the designated Bid opening.
7. **CONTRACT TIMES.** The numbers of calendar days within which, or the dates by which, the Work is to be substantially completed and also completed and ready for final payment (the Contract Times) are set forth in the Bid Form.

8. **LIQUIDATED DAMAGES.** Provisions for liquidated damages, if any, are set forth in the Agreement.

9. **SUBSTITUTES OR "OR-EQUAL" ITEMS.** Bidder’s attention is directed to Article 6.5 of the General Conditions concerning substitutes and "or-equal" items. Where an item or material is specified by a proprietary name, it is done for the purpose of establishing a basis of quality and not for the purpose of limiting competition. The Engineer's intent is to consider alternative products which have the desired essential characteristics. The Engineer will consider any such products offered. Requests for acceptance of alternative products shall be made through Bidders quoting as prime Contractors. Acceptances for substitutions will not be granted directly to suppliers, distributors, or subcontractors. Pursuant to Section 133-3, General Statutes of North Carolina, the following procedures shall be used:

Bidders desiring to submit alternative product proposals for prior acceptance of the Engineers shall submit, in writing, such proposals from November 29th, 2018, until December 3rd, 2018. Applications received after this time will not be reviewed. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute, including drawings, cuts, performance and test data, and other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment, or other work that incorporation of the substitute would require shall be included. The Engineer shall consider and either accept or reject all alternative product proposals submitted.

If, by the close of the fifth day prior to the deadline for receiving Bid, the Engineer has accepted any alternative product proposals, the Quoting Documents shall be modified to include the alternative products. The Engineer shall publish the modification in an Addenda at least 5 days prior to the deadline for receiving Bids. The Engineer's decision of acceptance or rejection of a proposed substitute shall be final.

10. **SUBCONTRACTORS, SUPPLIERS, AND OTHERS.** If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, and other persons and organizations (including those who are to furnish the principal items of material and equipment) to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within 3 days after the opening submit to Owner the List of Subcontractors completed with all such Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work for which such identification is required. The list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, person, or organization, if requested by Owner. If Owner or Engineer after due investigation has reasonable objection to any proposed Subcontractor, Supplier, or other person or organization, Owner may, before the Notice of Award is given, request the apparent Successful Bidder to submit an acceptable substitute without an increase in the Bid.

All Subcontractors shall be a licensed utility contractor in the State of North Carolina.

11. **BID FORM.** The Bid Form is bound in the Quoting Documents and shall not be removed therefrom. Bid Forms must be completed in ink.

Bids by corporations must be executed in the corporate name by the president or vice-president (or other corporate officer accompanied by evidence of authority to sign for the corporation). Bids by partnerships must be executed in the partnership name and signed by a partner. Bids by joint ventures shall be signed by each participant in the joint venture or by a representative of the joint venture accompanied by evidence of authority to sign for the joint venture.
The names of all persons signing shall be legibly printed below the signature. A Bid by a person who affixes to his signature the word "president", "secretary", "agent", or other designation without disclosing his principal may be held to be the Bid of the individual signing. When requested by Owner, evidence of the authority of the person signing shall be furnished.

All blanks in the Bid Form shall be filled. A Bid price shall be indicated for each unit price item listed therein, or the words "No Bid", "No Charge", "No Change", or other appropriate phrase shall be entered.

The Bid shall contain an acknowledgment of receipt of all Addenda; the numbers and dates of which shall be filled in on the Bid Form.

No alterations in Bids, or in the printed forms therefore, by erasures, interpolations, or otherwise will be acceptable unless each such alteration is signed or initialed by the Bidder; if initialed, Owner may require the Bidder to identify any alteration so initialed.

11.01. Bid Pricing. The Bidder shall complete the schedule of unit prices included in the Bid Form and shall accept all fixed unit prices listed therein.

The total Bid will be determined as the sum of the products of the estimated quantity of each item and the unit price Bid. The final Contract Price will be subject to adjustment according to final measured, used, or delivered quantities as provided in Article 9.7 of the General Conditions, and the unit prices in the Bid will apply to such final quantities except that unit prices will be subject to change by Change Order as stipulated in the Supplementary Conditions.

11.02. Contingency. The Contingency is to be added to the Bid price and is to be used for minor change order items. If the Contingency is to be used, a scope of work and price would be negotiated. The Contingency is for the sole use of Owner. A change order will be issued to delete any unauthorized portion of the Contingency.

12. SUBMISSION OF BIDS. Bids shall be submitted at the time and place indicated in the Invitation to Bid, or the modified time and place indicated by Addendum. Bids are due December 12th, 2018 at 2:00 PM and shall be enclosed in a sealed envelope or wrapping, addressed to:

The City of Concord
Enrique Blat, PE, Deputy City Engineer
635 Alfred Brown, Jr. Court SW
Concord, North Carolina 28026-0308

Bids shall be marked with the name, license number, and address of the Bidder and shall be accompanied by the Bid security (if required) 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 the notation "BID ENCLOSED" on the face of it.

Each Bid envelope shall be identified on the outside with the words:

“BID FOR CORBAN AVENUE PUMP STATION REHABILITATION – 2018-2385”

Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.
One copy of all pages of the BID FORM must be submitted with the Bid, as well as a Bid Bond and Debarred Firms Certification Form.

Oral, telephone, facsimile, or telegraph Bids are invalid and will not receive consideration.

No Bidder may submit more than one Bid. Multiple Bids under different names will not be accepted from one firm or association.

A conditional or qualified Bid will not be accepted.

13. MODIFICATION AND WITHDRAWAL OF BIDS. Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered to the place where Bids are to be submitted at any time prior to the opening of Bids.

If, within 24 hours after Bids are opened, any Bidder files a duly signed, written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid and the Bid security (if any) will be returned. Thereafter, that Bidder will be disqualified from further quoting on the Work to be provided under the Contract Documents.

14. OPENING OF BIDS. Bids will be opened at the office and at the discretion of the Director of Engineering and read aloud.

The procedure for opening Bids will follow guidelines issued by the State Building Commission dated December 10, 1990, and endorsed by the Consulting Engineers Council of North Carolina.

15. BIDS TO REMAIN SUBJECT TO ACCEPTANCE. All Bids will remain subject to acceptance for the number of days set forth in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the security (if any) prior to that date.

16. AWARD OF CONTRACT. Owner reserves the right to reject any or all Bids, including without limitation the rights to reject any or all nonconforming, nonresponsive, unbalanced, or conditional Bids, and will award to lowest responsible Bidder taking into consideration quality, performance, and time specified in Bid Form for performance of Work. Owner also reserves the right to waive informalities.

In evaluating Bids, Owner will consider the qualifications of the Bidders, whether or not the Bids comply with the prescribed requirements, and such alternatives, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

Owner may consider the qualifications and experience of Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other persons and organizations must be submitted as provided in the Supplementary Conditions. Owner also may consider the operating costs, maintenance requirements, performance data, and guarantees of major items of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to the Notice of Award.

Owner may conduct such investigations as Owner deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents to Owner's satisfaction within the prescribed time.

If the Contract is to be awarded, it will be awarded to the lowest Bidder whose evaluation by Owner indicates to Owner that the award will be in the best interests of Owner. If the Contract is to be awarded,
Owner will give the Successful Bidder a Notice of Award within the number of days set forth in the Bid Form. The evaluation of Suppliers' or manufacturers' data submitted with the Bid, or submitted upon request prior to the Notice of Award, will include consideration of the following:

- Owner-required inventory of spare parts.
- Building design changes which would be required to accommodate the proposed materials and equipment.
- Installation requirements and related engineering, training, and operating costs.
- Experience and performance record of the Supplier or the manufacturer.
- Maintenance and frequency of inspections required to assure reliable performance of the equipment.
- Suppliers' or manufacturers' service facilities and availability of qualified field service personnel.
- Efficiency and related operating expense during the anticipated useful life of the equipment.

17. **CONTRACT SECURITY.** The General Conditions set forth Owner's requirements as to Performance and Payment Bonds (required). These Bonds shall be delivered to Owner with the executed Agreement.

18. **SIGNING OF AGREEMENT.** When Owner gives a Notice of Award to the Successful Bidder, it will be accompanied by two unsigned counterparts of the Agreement with all other written Contract Documents attached. Within the number of days set forth in the Bid Form, the Successful Bidder shall sign, leaving the dates blank, and deliver the required number of counterparts of the Agreement and attached documents to Owner with the required Bonds and power of attorney. Within 30 days thereafter, Owner shall execute all copies of the Agreement and other Contract Documents submitted by Contractor (Successful Bidder); shall insert the date of contract on the Agreement, Bonds, and power of attorney; and shall distribute signed copies as stipulated in the Agreement.

Should the Owner not execute the Contract within the period specified, the Successful Bidder may, by written notice, withdraw his signed Contract. Such notice or withdrawal shall be effective upon receipt of the notice by the Owner.

19. **SALES AND USE TAXES.** Provisions for sales and use taxes, if any, are set forth in the Supplementary Conditions.

20. **RETAINAGE.** Provisions concerning retainage are set forth in the Agreement.

21. **LAWS AND REGULATIONS.** Modifications, if any, to the General Conditions concerning Laws and Regulations are set forth in the Supplementary Conditions. Additional provisions, if any, concerning Laws and Regulations are set forth in the Agreement.

21.01. **Collusive Bidding.** In accordance with Section 112(c) of Title 23 USC, and G.S. 75-5(b)(7) of the State of North Carolina, the Contractor (Bidder), by submission and execution of this bid or Bid, certifies that he has not entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding or quoting in connection with his Bid on this project.

End of Section
DEBARRED FIRMS CERTIFICATION FORM

Corban Avenue Pump Station Rehabilitation
Project No. 2018-2385

The undersigned hereby certifies that the firm of ________________________________ has not been suspended by the State of North Carolina or any agency or department thereof for conviction or indictment or any of the offenses enumerated in G.S. 133-27 nor will award subcontracts of any tier to firms that have been suspended for conviction or indictment of any of the offenses enumerated in G.S. 133-27.

__________________________
Name of Firm

ATTEST ____________________________ (SEAL)

______________________________
Signature of Authorized Official

______________________________
Title

Sworn and subscribed before me this
______ day of ____________, 2018

______________________________
Notary Public
EXHIBIT A – BID FORM

PROJECT IDENTIFICATION:

Corban Avenue Pump Station Rehabilitation
Project No. 2018-2385 (Re-advertisement)

THIS BID IS SUBMITTED TO:

Enrique Blat, PE, Deputy City Engineer
City of Concord
635 Alfred Brown, Jr. Court SW
Concord, North Carolina 28026-0308

1. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an agreement with Owner in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents within the specified time and for the amount indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.

2. Bidder accepts all of the terms and conditions of the Invitation to Bid and the Instructions to Bid, including without limitation those dealing with the disposition of the Bid security (if security is required by the City Manager)

3. This Bid will remain subject to acceptance for 60 days after the day designated for reception of Bids. Bidder will sign and submit the Agreement with the Bonds and other documents required by the Quoting Documents within 10 days after the date of Owner's Notice of Award.

4. In submitting this Bid, Bidder represents that:

   a. Bidder has examined copies of all the Quoting Documents and of the following Addenda (receipt of all which is hereby acknowledged):

      No. ______________________        Dated_________________  

      No. ______________________        Dated_________________  

      No. ______________________        Dated_________________  

      No. ______________________        Dated_________________  

      No. ______________________        Dated_________________  

   b. Bidder has visited the site and become familiar with and satisfied itself as to the general, local, and site conditions that may affect cost, progress, performance, and furnishing of the Work.

   c. Bidder is familiar with and has satisfied itself as to all Federal, State, and Local Laws and Regulations that may affect cost, progress, performance, and furnishing of Work.
d. Bidder has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except underground facilities) which have provided by the owner and under the conditions normally used and identified in the Supplementary Conditions and Special Conditions as provided in Paragraph 4.2.1 of the General Conditions. Bidder accepts the determination set forth in the Supplementary Conditions and Special Conditions of the extent of the “technical data” contained in such reports and drawings upon which Bidder is entitled to rely as provided in Paragraph 4.2 of the General Conditions. Bidder acknowledges that such reports and drawings are not Contract Documents and may not be complete for Bidder’s purposes. Bidder acknowledges that Owner and Engineer do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Quoting Documents with respect to underground facilities at or contiguous to the site. Bidder has obtained and carefully studied (or assumes responsibility for having done so) all such additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and underground facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance, or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder and safety precautions and programs incident thereto. Bidder does not consider that any additional examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance and furnishing of the Work in accordance with the time, price, and other terms and conditions of the Contract Documents.

e. Bidder is aware of the general nature of Work to be performed by Owner and others at the site that relates to Work for which this Bid is submitted as indicated in the Contract Documents.

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

g. Bidder has given Engineer written and verbal notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Contract Documents and the written resolution thereof by Engineer is acceptable to Bidder, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work for which this Bid is submitted.

h. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid Bidder has not solicited or induced any person, firm, or corporation to refrain from quoting; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

5. Bidder will complete the Work for the following unit prices. Quantities indicated are estimated and not guaranteed; they are solely for comparing Bids and establishing the initial Contract Price. Final payment will be based on actual quantities.
EXHIBIT A – BID FORM

Corban Avenue Pump Station Rehabilitation
Project No. 2018-2385 (Re-advertisement)

<table>
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<th>Item #</th>
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<td>Furnish and Install New Portable Generator Connection</td>
<td>LS</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>01630 1.6 G</td>
<td>Demolition / Demobilization</td>
<td>LS</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ESTIMATED BASE COST $ _____________________
10% CONTINGENCY $ _____________________
TOTAL ESTIMATED COST $ _____________________
6. Bidder agrees that all work will be completed and ready for final payment in accordance with Paragraph 14.13 of the General Conditions within 150 days from the date of notice to proceed.

7. Liquidated damages are $250.00 per each day past the contract completion date.

8. Communications concerning this Bid shall be sent to Bidder at the following address:

   NAME: ________________________________
   ADDRESS: ________________________________
   P.O. BOX: ________________________________
   CITY: ________________________________
   STATE: ________________________________
   ZIP: ________________________________

9. The terms used in this BID, which are defined in the General Conditions (Section II), have the meanings assigned to them in the General Conditions.

   SIGNATURE OF BIDDER: ________________________________
   Contractor’s License Number ________________________________
   License Expiration Date ________________________________

   If an Individual
   By ________________________________
   (signature of individual)
   doing business as ________________________________
   Business address ________________________________
   Phone No. ________________________________
   Date ________________________________, 20__
   ATTEST _______________ TITLE

   If a Partnership
   By ________________________________
   (firm name)
   ________________________________
   (signature of general partner)
   Business address ________________________________
   Phone No. ________________________________
   Date ________________________________, 20__
If a Corporation

By ________________________________ (corporation name)

By ________________________________ (signature of authorized person) (title)_____________________

Business address ________________________________

Phone No. ________________________________

Date ________________________________, 20_____

If a Joint Venture (Other party must sign below.)

By (name)_______________________________________________

Contractor's License Number ________________________________

License Expiration Date ________________________________

If an Individual

By ________________________________ (signature of individual)

doing business as ________________________________

Business address ________________________________

Phone No. ________________________________

Date ________________________________, 20_____

If a Partnership

By ________________________________ (firm name)

_____________________________________________ (signature of general partner)

Business address ________________________________
Phone No. ________________________________

Date ________________________________, 20____

ATTEST ___________ TITLE ________

If a Corporation

By ________________________________

(corporation name)

By ________________________________

(signature of authorized person)(title)_____________________

Business address ________________________________

Phone No. ________________________________

Date ________________________________, 20____

ATTEST ___________ TITLE ________

(Seal) □
<table>
<thead>
<tr>
<th>Date of Execution of this Bond</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name and Address of Principal (Contractor)</td>
<td></td>
</tr>
<tr>
<td>Name and Address of Surety</td>
<td></td>
</tr>
<tr>
<td>Name and Address of Contracting Body</td>
<td></td>
</tr>
<tr>
<td>Amount of Bond</td>
<td></td>
</tr>
<tr>
<td>Contract</td>
<td>That certain contract by and between the Principal and the Contracting Body above named dated for</td>
</tr>
</tbody>
</table>

KNOW ALL MEN BY THESE PRESENTS, that we, the PRINCIPAL and SURETY above named, are held and firmly bound unto the above-named Contracting Body, hereinafter called the Contracting Body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, 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 Contracting Body, identified as shown above and hereto attached;

NOW THEREFORE, if the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the Contracting Body, with or without notice to the Surety, and during the life of any guaranty required under the contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications of the contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, then, this obligation to be void; otherwise, to remain in full force and virtue.
STANDARD FORM OF PERFORMANCE BOND: (Continued)

THIS PERFORMANCE BOND is made and given pursuant to the requirements and provisions of Section 129 of Chapter 143 of the General Statutes of North Carolina and pursuant to Article 3 of Chapter 44-A of the General Statutes of North Carolina, and each and every provision set forth and contained in Section 129 of Chapter 143 and in Article 3 of Chapter 44-A of the General Statutes of North Carolina is incorporated herein, made a part hereof, and deemed to be conclusively written into this Bond.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals as of the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned and representative, pursuant to authority of its governing body.

WITNESS:

(Proprietorship or Partnership)
Printed Name_______________________

BY _____________________________ (SEAL)
Printed Name_______________________

TITLE _____________________________
(Owner, Partner, Office held in corporation, joint venture)

(Corporate Seal of Principal)

ATTEST: (Corporation)

BY _____________________________
Printed Name_______________________

TITLE _____________________________
(Corporation Secretary or Assistant Secretary Only)

Surety (Name of Surety Company)

BY _____________________________
Printed Name_______________________

TITLE Attorney in Fact

(Corporate Seal of Surety)

(Address of Attorney in Fact)

N.C. Licensed Resident Agent
EXHIBIT C – PROJECT SPECIAL PROVISIONS

Corban Avenue Pump Station Rehabilitation
Project No. 2018-2385

1) Hours of work at between 7:00 am – 6:00 pm; Monday through Friday.
2) Include in asphalt prices the cost of milling to tie into existing asphalt according to the Utility Cut Replacement Detail shown in the project plans.
3) There have been no subsurface studies or testing completed for this project. **Bidder agrees that all excavation is UNCLASSIFIED.**
4) The Contractor is responsible to supply, install, and maintain all the signs required for traffic control. Traffic control, if required, shall be considered incidental to all other bid items. There will be no separate payment for traffic control.
5) The Contractor shall include the cost of any coordination and cooperation of utilities in his bid. No additional compensation shall be allowed for delays or inconvenience sustained by the Contractor due to utility relocation or adjustments. No additional payment will be made for re-mobilization required by the utility’s failure to relocate a utility at the request of the Contractor.
6) **Financial Responsibility, Sedimentation Pollution Control Act:** If this project is subject to the “North Carolina Department of Environmental Health and Natural Resources Sediment Pollution Control Act”, the City has already acquired the permit. The Contractor, upon recommendation of award shall complete Part B of the Financial Responsibility/Ownership form provided by the City. The City will then transfer financial responsibility of the erosion control permit to the Contractor. The City of Concord will pay the cost of the application fees. The Contractor will be responsible for any fines levied for violation of the approved erosion control plan.
7) The two (2) new 50 HP VFD’s shall be supplied by others. The delivery of these units is estimated to occur prior to the delivery of other major project components to be furnished by the contractor.
8) The existing electrical transformer and pad shall remain and be used for the new installation. A new pad and transformer WILL NOT be required.
9) The City will honor the request for a delayed notice to proceed for the project to account for longer lead items. Documentation of lead times will be required before the request is granted.
10) The entrance to the building for the new electrical service shall remain as designed per sheet E2 of the drawings. The existing site fence will need to be removed in this location prior to performing work, and replaced once work is complete. The contractor shall limit the duration of the fence being down to the greatest extent possible and install temporary fencing to keep the site secure during the time in which the existing site fence is down during work.
11) New pumps shall meet all requirements of NSF/ANSI 61.
12) Air valves shall be installed on top of the new pumps. New air valves shall be supplied by the pump manufacturer to ensure compatibility and be suitable for potable water use.
13) All nuts and bolts to be used with flanged piping application shall be 304 stainless steel.
14) The Contractor shall be responsible for obtaining an electrical permit with the City.
15) The existing data recorder panel on the north wall shall remain. Please reference sheet E3.
16) Existing QEI panel on the west wall (north of building door) shall be removed. Please reference sheet E3. This work shall be coordinated with the City’s SCADA contractor.
17) Removal of existing SCADA conduits shall not be included in this contract. The contractor shall coordinate any SCADA work with the City’s SCADA contractor.
NOTICE OF AWARD

TO:

FROM: City of Concord City Council (OWNER)
P.O. Box 308
35 Cabarrus Ave. W
Concord, North Carolina 28026-0308

PROJECT: Corban Avenue Pump Station Rehabilitation
Project No. 2018-2385

You are hereby notified that the bid submitted by you for the above named project in response to the City of Concord’s Invitation to Bid dated November 29th, 2018 in the amount of

$________________________ and ________/100 DOLLARS

($____________________) has been accepted.

You are hereby required to execute the formal AGREEMENT with the City of Concord City Council and to furnish any and all Contractor’s Bond(s), Certificate of Insurance and Power of Attorney(s) along with other documents pertaining to the work as designated by the City of Concord.

If you fail to execute said AGREEMENT and to furnish this and any other required documents pertaining to the work within ten (10) days from the date of delivery of this NOTICE OF AWARD, said Owner will be entitled to consider all your rights arising out of the Owner’s acceptance of your bid as abandoned and to award the work covered by your proposal to another, or to re-bid the work or otherwise dispose thereof as the Owner may see fit.

Dated this the _______ day of ______________, 20____

City of Concord, North Carolina

By: ____________________________
Title: City Manager

CONTRACTOR

By: ____________________________
Title: __________________________

ACCEPTANCE OF NOTICE OF AWARD

Receipt of the above NOTICE OF AWARD is hereby acknowledged this the ____ day of ____________, 20____.
NOTICE TO PROCEED

TO:

FROM: City of Concord City Council (OWNER)
P.O. Box 308
35 Cabarrus Ave. W
Concord, North Carolina 28026

PROJECT: Corban Avenue Pump Station Rehabilitation
Project No. 2018-2385

Contract Amount: _____________________________ and ___/100 DOLLARS ($________). 

You are hereby notified to commence work on or before the ______ day of ______, 20__, pending acceptance of your Certificate of Insurance and any other required documents, and are to fully complete the work by the ____ day of ________________, 20__.

Your project final completion date is therefore the __________ day of _____________, 20__, and as set forth in the above named project’s schedule unless an extension is granted by the City of Concord Director of Engineering in writing.

City of Concord, North Carolina

By: ________________________________

Title: City Manager

Dated this the ___ day of __________, 20___________.

23
STANDARD FORM CONSTRUCTION CONTRACT

This contract (together with all exhibits and valid amendments, the “Agreement” or the “Contract”) is made and entered into as of the ___ day of __________________, 20___, by the City of CONCORD (“City”) and ____________________________ (“Contractor”), ( ) a corporation, ( ) a professional corporation, ( ) a professional association, ( ) a limited partnership, ( ) a sole proprietorship, or ( ) a general partnership; organized and existing under the laws of the State of _________________________.

Sec. 1. Background and Purpose. The Corban Avenue Pump Station Rehabilitation project generally consists of the replacement of two (2) existing 15 HP horizontal split case pumps and motors with new 40 HP pumps and motors, adjustments to existing suction and discharge piping related to pump replacements, replacement of existing motor control center, installation of two (2) new variable frequency drives for new pumps (provided by others), and installation of a new exterior portable generator connection.

Sec. 2. Services and Scope to be Performed. The Contractor shall provide the services at the charges set forth either in this paragraph or in Exhibit “A”. Additional exhibits may be used to further define this Agreement when the Contractor and City so agree. Any additional exhibits shall be designated as exhibits to the Agreement with capitalized, sequential letters of the alphabet, shall be attached hereto and incorporated herein by reference as if the same were fully recited, and shall become terms of this Agreement upon execution by both parties.

In this Contract, “services” means the services that the Contractor is required to perform pursuant to this Contract and all of the Contractor’s duties to the City that arise out of this Contract. Any amendments, corrections, or change orders by either party must be made in writing signed in the same manner as the original. (This form may be used for amendments and change orders.) The City reserves the right to refuse payment for any work outside that authorized herein or pursuant to a duly approved amendment or change order.

Sec. 3. Complete Work without Extra Cost. Unless otherwise provided, the Contractor shall obtain and provide, without additional cost to the City, all labor, materials, equipment, transportation, facilities, services, permits, and licenses necessary to perform the Work.

Sec. 4. Compensation. The City shall pay the Contractor for the Work as described in this paragraph below OR as described in Exhibit “A” attached. In the event of a conflict, the provisions of this paragraph shall control. Any additional expenses or charges shall only be paid after both the City and the Contractor agree to and execute a written change order. The City shall not be obligated to pay the Contractor any fees, payments, expenses or compensation other than those authorized in this Contract or in a duly-approved amendment or change order. All payments shall be deemed inclusive of tax and other obligations.

Sec. 4a. Retainage. The City shall withhold no retainage on Contracts having a “total project cost” of less than $100,000.00. The City may withhold retainage on contracts having a total project cost between $100,000 and $200,000. The City shall withhold retainage on contracts whose total project cost exceeds $300,000. When withheld, retainage shall equal no more than five percent of each progress payment. When the project is fifty percent complete, the City shall not retain anything from future project payments provided that (i) the surety concurs in writing, (ii) the Contractor continues to perform satisfactorily, (iii) any non-conforming work identified in writing by the architect, engineer(s) or City has been corrected by the Contractor and accepted by the architect, engineer(s) or City. However, if the City determines that the Contractor’s performance is unsatisfactory, the City may withhold up to five percent retainage from each project payment. The City may withhold additional amounts above five percent for unsatisfactory job progress, defective construction not remedied, disputed work, third party claims filed against the owner or reasonable evidence that a third-party claim will be filed.

Definitions:

“Total Project Cost”: Total value of the Contract and any approved change orders or amendments.

“Project is Fifty Percent Complete”: When the Contractor’s validly-issued gross project invoices (excluding the value of the materials stored off-site) equal or exceed fifty percent of the value of the Contract, except that the value of materials stored on-site shall not exceed twenty percent of the Contractor’s gross project invoices for the purpose of determining whether the project is fifty percent complete.
Sec. 5. **Term.** The Contractor shall commence work within ten (10) days of the date of its receipt of written Notice to Proceed from the City. The date that is ten (10) days from the date of the Contractor’s receipt of the Notice to Proceed shall be the “Commencement Date.” All work as set forth in the Scope of Services in Exhibit “A” shall be completed within one hundred and fifty (150) calendar days of the Commencement Date. The date that is one hundred and fifty (150) calendar days from the Commencement Date shall be the “Completion Date.” Time is of the essence with regard to this Project. If Contractor’s obligations are not completed by the Completion Date, the City reserves the right to nullify this Agreement, order the Contractor to immediately cease all work under this Agreement and vacate the premises, and to seek professional services equivalent to those outlined in Exhibit “A.” The Contractor shall be held accountable for all damages incurred by the City as a consequence of the missed Completion Date. The exercise of any of these rights by the City shall not be interpreted to prejudice any other rights the City may have under this Agreement or in law or equity. This Contract shall not be automatically extended unless agreed to in writing by the City or as provided in Exhibit “A.”

Sec. 6. **Contractor’s Billings to City.** Payments will be made in accordance with the schedule found in this section below OR attached at Exhibit “A”. Contractor shall submit an original pay request (invoice) to the City Purchasing Agent by the first of each month in order to expedite payment. Upon receipt of the request the City Purchasing Agent shall verify the amounts and if correct forward the request to the Accounts Receivable Division of the Finance Dept. Final payment on the Contract shall be made in 45 days, except in the case of retainage. Within 60 days after the submission of the final pay request, the City (with the written consent of the surety) shall release to the Contractor all retainage payments IF the City receives a certificate of substantial completion from the architect, engineer or designer-in-charge of the project OR the City receives beneficial occupancy and use of the project. In either case, the City may retain up to 2.5 times the estimated value of the work to be completed or corrected.

Sec. 7. **Insurance.** Contractor shall maintain and cause all sub-contractors to maintain insurance policies at all times with minimum limits as follows:

<table>
<thead>
<tr>
<th>Coverage</th>
<th>Minimum Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers’ Compensation</td>
<td>$100,000 each accident, $100,000 bodily injury by disease each employee, $500,000 bodily injury by disease policy limit</td>
</tr>
<tr>
<td>General Liability</td>
<td>$1,000,000 per occurrence regardless of the contract size</td>
</tr>
<tr>
<td>Automobile Liability</td>
<td>$1,000,000 per occurrence regardless of the contract size</td>
</tr>
<tr>
<td>Umbrella</td>
<td>$1,000,000 per occurrence if contract does not exceed 180 days and does not exceed $500,000; otherwise, $2,000,000 per occurrence</td>
</tr>
</tbody>
</table>

Contractor shall provide a Certificate of Insurance to the City listing the City as an additional insured. Such Certificate shall be in a form acceptable to the City.

Sec. 8. **Documentation Requirements:**

A. Contractor shall provide the City with a Certificate of Insurance for review prior to the issuance of any contract or Purchase Order. All Certificates of Insurance will require written notice by the insurer or Contractor’s agent in the event of cancellation, reduction or other modifications of coverage by the insurer. Such notice shall be not less than 30 days for nonrenewal by the insurer, not less than 10 days for cancellation due to nonpayment of the premium and as soon as possible for all other types of modifications. In addition to the notice requirement above, Contractor shall provide the City with written notice of cancellation, reduction, or other modification of coverage of insurance whether instigated by the insurer or by the Contractor immediately upon Contractor’s receipt of knowledge of such modifications. Upon failure of the Contractor to provide such notice, Contractor assumes sole responsibility for all losses incurred by the City for which insurance would have provided coverage. The insurance certificate shall be for the insured period in which the initial contract period begins and shall be renewed by the Contractor for each subsequent renewal period of the insurance for so long as the contract remains in effect.

The City shall be named as an additional insured on all policies except Workers’ Compensation and it is required that coverage be placed with “A” rated insurance companies acceptable to the City. Statement should read, “City of Concord is added as an additional insured as evidenced by an endorsement attached to this certificate.”
Failure to maintain the required insurance in force may be cause for termination of this Agreement. In the event that the Contractor fails to maintain and keep in force the insurance herein required, the City has the right to cancel and terminate the Agreement without notice.

B. Contractor shall provide a completed W-9 form to the City prior to execution by the City of this Agreement.

Sec. 9. Performance of Work by Contractor.

(a) The Contractor warrants that all work performed under this Contract conforms to the Contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier. This warranty shall continue for a period of 1 year from the date of issuance by the City of written final completion of the work.

(b) The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to City-owned or controlled real or personal property, when that damage is the result of--

(1) The Contractor's failure to conform to contract requirements; or

(2) Any defect of equipment, material, workmanship, or design furnished.

(c) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

(d) The City shall notify the Contractor, in writing, within a reasonable time, not to exceed 30 days, after the discovery of any failure, defect, or damage.

(e) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time, not to exceed 30 days unless otherwise agreed in writing and signed by the City Manager or his designee, after receipt of notice, the City shall have the right to replace repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

(f) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this Contract, the Contractor shall--

(1) Obtain all warranties that would be given in normal commercial practice,

(2) Require all warranties to be executed, in writing, for the benefit of the City, if directed to do so by the City; and

(3) Enforce all warranties for the benefit of the City, if directed to do so by the City

(g) In the event the Contractor’s warranty has expired, the City may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

(h) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the City nor for the repair of any damage that results from any defect in City-furnished material or design.

Sec. 10. Performance of Work by City. If the Contractor fails to perform the Work in accordance with the schedule referred to in Exhibit "A", the City may, in its discretion, perform or cause to be performed some or all of the Work, and doing so shall not waive any of the City’s rights and remedies. Before doing so, the City shall give
the Contractor reasonable notice of its intention. The Contractor shall reimburse the City for all costs incurred by the City in exercising its right to perform or cause to be performed some or all of the Work pursuant to this section.

**Sec. 11. Attachments.** Additional exhibits may be used to further define this Agreement when the Contractor and City so agree. Any additional exhibits shall be designated as exhibits to the Agreement with capitalized, sequential letters of the alphabet, shall be attached hereto and incorporated herein by reference as if the same were fully recited, and shall become terms of this Agreement upon execution by both parties.

*The following attachments* are made a part of this Contract and incorporated herein by reference:

(a) Exhibit “A” – BID FORM
(b) Exhibit “B” – Standard Form of Performance Bond
(c) Exhibit “C” – Special Provisions
(d) Exhibit “D” – Contractor must execute the Affidavit attached as Exhibit “D”, attesting to compliance with state and federal laws related to E-Verify. *This requirement only applies to contracts that fall within the formal bidding range.*
(e) Exhibit “E” – Tax Form(s).
(f) Exhibit “F” – Certificate of Insurance.

In case of conflict between an attachment and the text of this contract excluding the attachment, the text of this contract shall control. Any attachment that materially alters the standard terms contained herein must be reviewed by the City Attorney and approved by the City in writing.

**Sec. 12. Notice.** (a) All notices and other communications required or permitted by this Contract shall be in writing and shall be given either by personal delivery, fax, or certified United States mail, return receipt requested, addressed as follows:

To the City:
Sue Hyde, Director of Engineering
City of Concord
P.O. Box 308
Concord, NC 28026
Fax Number: (704) 786-4521

To the Contractor:
VaLerie Kolczynski, Esq.
City Attorney
PO Box 308
Concord, NC 28026
Fax Number: (704) 784-1791

(b) Change of Address, Date Notice Deemed Given: A change of address, fax number, or person to receive notice may be made by either party by notice given to the other party. Any notice or other communication under this Contract shall be deemed given at the time of actual delivery, if it is personally delivered or sent by fax. If the notice or other communication is sent by US Mail, it shall be deemed given upon the third calendar day following the day on which such notice or other communication is deposited with the US Postal Service or upon actual delivery, whichever first occurs.

**Sec. 13. Indemnification.** To the maximum extent allowed by law, the Contractor shall defend, indemnify, and save harmless the City of Concord, its agents, officers, and employees, from and against all charges that arise in any manner from, in connection with, or out of this Contract as a result of the acts or omissions of the Contractor or subcontractors or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable except for damage or injury caused solely by the negligence of the City its agents, officers, or employees. In performing its duties under this section, the Contractor shall at its sole expense defend the City of Concord, its agents, officers, and employees with legal counsel reasonably acceptable to City. As used in this subsection – “Charges” means claims, judgments, costs, damages, losses, demands, liabilities, duties, obligations, fines, penalties, royalties, settlements, expenses, interest, reasonable attorney’s fees, and amounts for alleged violations of sedimentation pollution, erosion control, pollution, or other environmental laws, regulations, ordinances, rules, or orders. Nothing in this section shall affect any warranties in favor of the City that are otherwise provided in or arise out of this Contract. This section is in addition to and shall be construed separately from any other indemnification provisions that may be in this Contract. This section shall remain in force despite termination of this Contract (whether by expiration of the term or otherwise) and termination of the services of the Contractor under this Contract.

**Sec. 14. Corporate Status.** If the Contractor is dissolved or suspended and the Contractor does not notify the City of such dissolution within three (3) business days from date of dissolution or suspension, and/or the corporate status is not reinstated within thirty (30) days, this Contract, at the sole option of the City and without prejudice to
City’s other remedies, shall be declared null and void or the Contractor shall execute a new contract showing the Contractor’s correct legal entity.

Sec. 15. Miscellaneous.

(a) **Choice of Law and Forum.** This Contract shall be deemed made in Cabarrus County, North Carolina. This Contract shall be governed by and construed in accordance with the laws of North Carolina. The exclusive forum and venue for all actions arising out of this Contract shall be the appropriate division of the North Carolina General Court of Justice, in Cabarrus County. Such actions shall neither be commenced in nor removed to federal court. This section shall not apply to subsequent actions to enforce a judgment entered in actions heard pursuant to this section.

(b) **Waiver.** No action or failure to act by the City shall constitute a waiver of any of its rights or remedies that arise out of this Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

(c) **Performance of Government Functions.** Nothing contained in this Contract shall be deemed or construed as to in any way estop, limit, or impair the City from exercising or performing any regulatory, policing, legislative, governmental, or other powers or functions.

(d) **Severability.** If any provision of this Contract shall be unenforceable, the remainder of this Contract shall be enforceable to the extent permitted by law.

(e) **Assignment, Successors and Assigns.** Without the City’s written consent, the Contractor shall not assign (which includes to delegate) any of its rights (including the right to payment) or duties that arise out this Contract. Unless the City otherwise agrees in writing, the Contractor and all assigns shall be subject to all of the City’s defenses and shall be liable for all of the Contractor’s duties that arise out of this Contract and all of the City’s claims that arise out of this Contract. Without granting the Contractor the right to assign, it is agreed that the duties of the Contractor that arise out of this Contract shall be binding upon it and its heirs, personal representatives, successors, and assigns.

(f) **Compliance with Law.** In performing all of the Work, the Contractor shall comply with all applicable law. Without limitation, Contractor shall comply with the requirements of Article 2, Chapter 64 (Verification of Work Authorization) of the North Carolina General Statutes relating to E-Verify. Further, if Contractor utilizes a subcontractor, Contractor shall require the subcontractor to comply with the requirements of Article 2 of Chapter 64 of the General Statutes.

(g) **City Policy.** THE CITY OPPOSES DISCRIMINATION ON THE BASIS OF RACE AND SEX AND URGES ALL OF ITS CONTRACTORS TO PROVIDE A FAIR OPPORTUNITY FOR MINORITIES AND WOMEN TO PARTICIPATE IN THEIR WORK FORCE AND AS SUBCONTRACTORS AND VENDORS UNDER CITY CONTRACTS.

(h) **EEO Provisions.** During the performance of this Contract the Contractor agrees as follows:

1. The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin, political affiliation or belief, age, or handicap. The Contractor shall take affirmative action to insure that applicants are employed and that employees are treated equally during employment, without regard to race, color, religion, sex, national origin, political affiliation or belief, age, or handicap. The Contractor shall post in conspicuous places available to employees and applicants for employment, notices setting forth these EEO provisions. (2) The Contractor in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, political affiliation or belief, age, or handicap.

(i) **No Third Party Right Created.** This Contract is intended for the benefit of the City and the Contractor and not any other person.

(j) **Principles of Interpretation.** In this Contract, unless the context requires otherwise the singular includes the plural and the plural the singular. The pronouns “it” and “its” include the masculine and feminine. Reference to statutes or regulations include all statutory or regulatory provisions consolidating, amending, or replacing the statute or regulation. References to contracts and agreements shall be deemed to include all amendments to them. The word “person” includes natural persons, firms, companies associations, partnerships, trusts, corporations, governmental agencies and units, and any other legal entities.

(k) ** Modifications, Entire Agreement.** A modification of this Contract is not valid unless signed by both parties and otherwise in accordance with requirements of law. Further, a modification is not enforceable against the City unless the City Manager or other duly authorized official signs it for the City. This Contract contains the entire agreement between the parties pertaining to the subject matter of this Contract. With respect to that subject matter, there are no promises, agreements, conditions, inducements, warranties, or understandings, written or oral, expressed or implied, between the parties, other than as set forth or referenced in this Contract.
(l) **Corporate Seal.** If a corporate seal is included by any party to this Contract, it is only for authentication purposes. This Contract is not signed under seal.

(m) **No Employment Relationship.** For all matters relating to this Agreement, Contractor shall be deemed an Independent Contractor. Nothing in this Agreement shall be construed in such a manner as to create an employee-employer relationship between City and Contractor.

(The following section applies to construction contracts only if amount is over $50,000)

**Sec. 16. Bonding.** Both performance and payment bonds for the full amount of this Contract are required to be attached. Instead of bonds, you may submit a deposit of money, certified check or government securities for the full amount of the Contract. The performance bond shall have a value equal to 100% of this Contract. This bond shall be conditioned upon faithful performance of the Contract in accordance with the plans, specifications and conditions of the Contract. The performance bond shall be solely for the protection of the City. The payment bond shall be in an amount equal to 100% of the Contract, and conditioned upon the prompt payment for all labor or materials for which a contractor or subcontractor is liable. The payment bond shall be solely for the protection of the persons furnishing materials or performance labor for which a contractor or subcontractor is liable.

**Sec. 17. Dispute Resolution.** It is understood and agreed that NCGS 143-128(f1-g) requires that disputes arising under an agreement for the erection, construction, alteration or repair of a building be subject to a dispute resolution process specified by the City. The amount in controversy shall be at least $15,000.00 before this dispute resolution procedure may be used. In compliance with this statutory provision, the City specifies this Section as the dispute resolution process to be used on this Project. It is further understood and agreed that this dispute resolution process is based on non-binding mediation and will only be effective to the extent that the Parties to any mediated dispute participate in the mediation in good faith. It is also understood and agreed that the City is under no obligation under any circumstance to secure or enforce the participation of any other Party in the mediation of any dispute subject to this Section and NCGS 143-128(f1-g).

**This Section 17 does not apply to:**

(a) The purchase and erection of prefabricated or relocatable buildings or portions of such buildings, except that portion of the work that must be performed at the construction site; or

(b) The erection, construction alteration or repair of a building when the cost of such building is $300,000 or less.

17.1 Any dispute arising between or among the Parties listed in Section 17.3 that arises from an agreement to construct the Project, including without limitation a breach of such agreement, shall be subject to non-binding mediation administered by the American Arbitration Association under its Construction Industry Mediation Rules (“Rules”), except as otherwise expressly set forth in this Section. To the extent any provision of the Rules is inconsistent with the provisions of this Section, the provisions of this Section shall control. The mediation provided in this Section shall be used pursuant to this Agreement and NCGS 143-128(f1-g) and is in lieu of any dispute resolution process adopted by the North Carolina State Building Commission, which process shall not apply to this Project.

17.2 For purposes of this Section the following definitions shall apply:

a. **Agreement to construct the Project** means an agreement to construct the Project that is subject to the requirements of NCGS 143-128 and does not include any agreement related to the Project that is not subject to said statute.

b. **Construct or construction** refers to and includes the erection, construction, alteration or repair of the Project.

c. **Party or Parties** refers to the parties listed in Section 16.4.

d. **Project** means the building to be erected, constructed, altered or repaired pursuant to this Agreement.
17.3 The City and any Party contracting with the City or with any first-tier or lower-tier subcontractor for the construction of the Project agree to participate in good faith in any mediation of a dispute subject to this Section and NCGS 143-128(f1-g), including without limitation the following Parties (if any): architect(s), engineer(s), surveyor(s), construction manager, construction manager at risk, prime contractor(s), surety(ies), subcontractor(s), and supplier(s).

17.4 In order to facilitate compliance with NCGS 143-128(f1-g), the Contractor and all other Parties shall include this Section 17 in every agreement to which it (any of them) is a Party for the construction of the Project without variation or exception. Failure to do so will constitute a breach of this Agreement, and the Contractor or other Party failing to include this Section in any agreement required by this Section shall indemnify and hold harmless the remaining Parties from and against any and all claims, including without limitation reasonable attorney fees and other costs of litigation, arising in any manner from such breach. Notwithstanding the foregoing provisions of this Section, it is expressly understood and agreed that the Parties are intended to be and shall be third-party beneficiaries of the provisions of this Section and can enforce the provisions hereof.

17.5 The following disputes are not subject to mediation: (i) a dispute seeking a non-monetary recovery; and (ii) a dispute seeking a monetary recovery of $15,000 or less.

17.6 A dispute seeking the extension of any time limit set forth in an agreement to construct the Project shall be subject to mediation pursuant to this Section and NCGS 143-128(f1-g), but only if the damages which would be suffered by the Party seeking the extension would exceed $15,000 if the disputed extension is denied. To the extent that liquidated damages are set forth in such agreement as the measurement of damages for failure by such Party to meet such time limit, such liquidated damages shall be the exclusive standard for determining the amount of damages associated with such dispute.

17.7 For purposes of this Section, a dispute is limited to the recovery of monetary damages from the same transaction or occurrence against a single Party or two or more Parties alleged to be liable jointly, severally or in the alternative. Two or more disputes may not be consolidated or otherwise combined without the consent of all Parties to such disputes.

17.8 In addition to such matters as are required by the Rules, a request for mediation shall include the amount of the monetary relief requested.

17.9 Prior to requesting mediation, a Party must form a good faith belief that it is entitled under applicable law to recover the monetary amount to be included in the request from one or more of the remaining Parties. Such belief must be based on a reasonable and prudent investigation into the dispute that is the subject of the request. The request for mediation must be based on such investigation and may not include any amount or the name of any remaining Party, unless supported by such investigation and good faith belief by the Party requesting the mediation.

17.10 If a Party breaches any provision of Section 17.9, it shall indemnify and hold harmless all other Parties from any costs, including reasonable attorney fees and other costs of litigation, and damages incurred by such other Parties that arise from such breach.

17.11 All expenses incurred by a Party to a dispute in preparing and presenting any claim or defense at the mediation shall be paid by the Party. Such expenses include without limitation preparation and production of witnesses and exhibits and attorney fees. All other expenses of the mediation, including filing fees and required traveling and other expenses of the mediator, shall be borne as follows: one half by the Party requesting the mediation, with the remaining parties paying equal shares of the remaining expenses and costs; provided that, if the City is named as a party to the mediation, the City shall pay at least one-third of the mediation expenses and costs divided among the Parties. If more than one Party to a dispute requests a mediation, the mediation expenses and costs to be divided among the Parties shall be borne equally by the Parties to the dispute; provided that, if the City is named as a Party to the mediation, the City shall pay at least one-third of the mediation expenses and costs divided among the Parties.

17.12 The mediation shall be held at a location agreeable to the mediator and all of the Parties; provided that, if no agreement can be reached, the mediation will be held at such location in Cabarrus County as the
mediator shall determine.

17.13 The provisions of this Section are subject to any other provision of this Agreement concerning the submission, documentation and/or proof of any claim or dispute. Such other provisions shall apply in full force and shall be satisfied as a condition precedent to mediation pursuant to this Section.

17.14 The Parties understand and agree that mediation in accordance with this Section shall be a condition precedent to institution of any legal or equitable proceeding seeking monetary recovery based on any dispute that is subject to mediation pursuant to this Section.

**Sec. 18. Breach.** In the event of a violation of any material term of this Agreement, the non-violating party may terminate the Agreement upon written notice. Such notice shall state the violation with specificity and shall give ten (10) days to cure the violation. The cure period shall be measured as ten (10) days from the date of receipt of notice by the violating party, or, if the date is not known, then thirteen (13) days from the date the notice is placed in the United States Post. If the violation remains uncorrected at the end of the cure period, the Agreement shall be terminated without any further action by the non-violating party. Any remaining disputes shall be subject to the dispute resolution procedure set forth above, if applicable.

[Signature Page to Follow]
IN WITNESS WHEREOF, the City of Concord and the Contractor have caused this Contract to be executed by their respective duly authorized agents or officers.

CITY OF CONCORD: ________________________

By: ________________________________
    City Manager

Date: ________________________________

ATTEST BY:

______________________________

City Clerk

Printed Name: ________________________________

Title: ________________________________

Date: ________________________________

ATTEST:

______________________________

BY:

Signature of Vice President, Secretary, or other officer

Printed Name: ________________________________

Title: ________________________________

APPROVED AS TO FORM:

______________________________

Attorney for the City of Concord

SEAL

APPROVAL BY CITY FINANCE OFFICER

This instrument has been pre-audited in the manner required by the Local Government Budget and Fiscal Control Act.

______________________________

Signature
EXHIBIT “D”

STATE OF NORTH CAROLINA
COUNTY OF CABARRUS

**************************

I, _________________________________(the individual signing below), being duly authorized by and on behalf of __________________________________________ (the legal name of the entity entering the contract, "Employer") after first being duly sworn hereby swears or affirms as follows:

1. Employer understands that E-Verify is the federal E-Verify program operated by the United States Department of Homeland Security and other federal agencies, or any successor or equivalent program used to verify the work authorization of newly hired employees pursuant to federal law in accordance with NCGS §64-25(5).

2. Employer understands that Employers Must Use E-Verify. Each employer, after hiring an employee to work in the United States, shall verify the work authorization of the employee through E-Verify in accordance with NCGS§64-26(a). Employer attests that Employer is in compliance with the requirements of the federal and state laws relevant to E-verify.

3. Employer is a person, business entity, or other organization that transacts business in the State of North Carolina. Employer employs 25 or more employees in this State. (mark Yes or No)
   a. YES _____, or b. NO _____.

4. Employer attests that all subcontractors employed by it as part of this contract comply with the requirements of E-Verify, and Employer will ensure compliance with E-Verify by any subcontractors subsequently hired by Employer as part of any contract with the City of Concord.

5. Employer shall have a continuing duty to inform the City of Concord of any changes to this sworn information.

This ____ day of ________________, 20___.

Signature of Affiant
Print or Type Name: ____________________________

State of North Carolina County of Cabarrus

Signed and sworn to (or affirmed) before me, this the _____
day of ________________, 20___.

My Commission Expires:

Notary Public
EXHIBIT “E”

TAX FORM(S)
EXHIBIT “F”

CERTIFICATE OF INSURANCE
City of Concord
Post Office Box 308
Concord, North Carolina 28026-0308

PROJECT: # DESCRIPTION: ___
Date Notice to Proceed: ___
Completion Date: ___
Days Remaining in Contract: ___
Percent Work Complete: ___
Percent Time Complete: ___
Percent Payment Complete: ___

APPLICATION FOR PAYMENT NO. ___ SHEET NO. ___ OF
PERIOD FROM: ___ TO: ___

CERTIFICATE OF THE CONTRACTOR

To the best of my knowledge and belief, I certify that this periodical estimate is correct and all work has been performed and materials supplied in full accordance with the terms and conditions of the contract documents between the undersigned contractor and the City of Concord.

GROSS AMOUNT OF PARTIAL PAYMENT $___

LESS: RETAINAGE AT ___ PERCENT $___
PREVIOUS PAYMENT $___
LIQUIDATION DAMAGES
___ DAYS @ $ ___ $___
OTHER DEDUCTIONS: $___

TOTAL DEDUCTIONS $___

NET AMOUNT DUE THIS ESTIMATE $___

Name of Contractor: ___________________________ Address: ___________________________

Signed: ___________________________ Title: ___________________________ Date: ______

CERTIFICATE OF CONSTRUCTION ADMINISTRATOR/ENGINEER

I certify that I have verified this periodical estimate and that to the best of my knowledge and belief, it is a true and correct statement of work performed and materials supplied under the contract.

Consultant Engineer: ___________________________ Date: ______
Construction Administrator: ___________________________ Date: ______

APPROVED AND PAYMENT RECOMMENDED:

CITY OF CONCORD

Signed: ___________________________ Title: ___________________________ Date: ______

FIN/AP/31
Revised 03/14/07
## ENGINEERING’S APPLICATION FOR PAYMENT FORM
### Corban Avenue Pump Station Rehabilitation
#### City of Concord

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Total Item Price</th>
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<tbody>
<tr>
<td>1</td>
<td>MOBILIZATION</td>
<td>1</td>
<td>LS</td>
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<tr>
<td>2</td>
<td>FURNISH AND INSTALL NEW HORIZONTAL SPLIT CASE PUMPS</td>
<td>2</td>
<td>EA</td>
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<td>3</td>
<td>FURNISH AND INSTALL SUCTION AND DISCHARGE PIPING IMPROVEMENTS</td>
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<td>4</td>
<td>FURNISH AND INSTALL NEW MOTOR CONTROL CENTER AND PRIMARY POWER</td>
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<td>5</td>
<td>INSTALL NEW VARIABLE FREQUENCY DRIVES</td>
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<td>6</td>
<td>FURNISH AND INSTALL NEW PORTABLE GENERATOR CONNECTION</td>
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<td>LS</td>
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<td>7</td>
<td>DEMOLITION / DEMOBILIZATION</td>
<td>1</td>
<td>LS</td>
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</tbody>
</table>

**BASE BID** $\$10% CONTINGENCY $\$
**TOTAL BASE BID** $\$
CITY OF CONCORD  
CONCORD, NORTH CAROLINA  
CONTRACT CHANGE ORDER  

Date: ____________________

Project Title: Corban Avenue Pump Station Rehabilitation  
Project #: 2018-2385

Owner: City of Concord  
Change Order No.

To:  
(CONTRACTOR)
Account No.
Purchase Order No.

You are hereby requested to make the following changes in this Contract to comply with the provisions of the attached and/or the original Contract Documents.

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description of Changes</th>
<th>Additions</th>
<th>Deductions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$0.00</td>
<td>$0.00</td>
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</table>

Original Contract Amount
Net Changes by Previous Change Orders
Net Changes this Change Order $0.00

New Contract Amount $0.00

The Contract Time will be _______________ by _______________ calendar days.
The Completion Date as of this Change Order is:

Accepted: (Contractor)
By: ____________________  
Date: ____________________

Accepted: CITY OF CONCORD
By: ____________________  
Date: ____________________

This instrument has been pre-audited in the manner required by Local Government Budget and Fiscal Control Act.

By: ____________________  
Date: ____________________  
Finance Director
CERTIFICATE OF INFRASTRUCTURE COMPLETION

<table>
<thead>
<tr>
<th>Project Title: Corban Avenue Pump Station Rehabilitation Project #: 2018-2385</th>
</tr>
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</table>

<table>
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<tr>
<th>CONTRACTOR NAME &amp; ADDRESS:</th>
<th>OWNER NAME &amp; ADDRESS:</th>
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MISCELLANEOUS INFORMATION:

INSPECTOR:  

The following items have been inspected, reviewed and found to be complete in substantial accordance with the approved plans and specifications. The dates of completion are those agreed upon by the City of Concord when all construction work and testing was completed. These dates DO NOT initiate the start of any warranty periods of said items(s). Warranty periods shall begin as specified on the CERTIFICATE OF FINAL COMPLETION.

<table>
<thead>
<tr>
<th>Item</th>
<th>Approved:</th>
<th>Date:</th>
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<tbody>
<tr>
<td>Stormwater System</td>
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<tr>
<td>Curb &amp; Gutters</td>
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<td>Sanitary Sewer</td>
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<td>Potable Water</td>
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<td>Street Paving</td>
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<tr>
<td>Sidewalks</td>
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<tr>
<td>Other</td>
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</tbody>
</table>

39
FIELD ORDER

CITY OF CONCORD
ENGINEERING DEPARTMENT
Post Office Box 308
Concord, North Carolina 28026-0308

Project Title: Corban Avenue Pump Station Rehabilitation Project #: 2018-2385

FIELD ORDER NO ______ CONTRACT ________________ DATE ____________________

PROJECT ______________________________________________________________________

LOCATION ____________________________________________________________________

b) TO: _______________________________________________________________________

______________________________________________________________________________

THIS ORDER AUTHORIZES YOU TO PROCEED WITH THE ALTERATIONS AND/OR ADDITIONS TO
THE WORK AS DESCRIBED HEREIN, IN ACCORDANCE WITH THE TERMS AND CONDITIONS OF
OUR STANDARD FORM OF CONTRACT.

DESCRIPTION OF WORK: ______________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

☐ QUOTATION RECEIVED AND APPROVED BY THE CITY OF CONCORD.
☐ QUOTATION NOT RECEIVED. PLEASE FURNISH QUOTATION IMMEDIATELY TO
THE CITY OF CONCORD FOR CHECK AND APPROVAL.
☐ TIME AND MATERIAL BASIS. FURNISH TIME AND MATERIAL REPORTS DAILY TO
THE CITY OF CONCORD FOR VERIFICATION AND SIGNATURE.
☐ OTHER ________________________________________________________________

AUTHORIZED BY: ____________________________________________________________

40
## NORTH CAROLINA SALES TAX REPORT

**OWNER:**

**CONTRACTOR:**

**Project Title:** Corban Avenue Pump Station Rehabilitation

**Project #:** 2018-2385

**PURCHASE ORDER:**

<table>
<thead>
<tr>
<th>DATE</th>
<th>VENDOR NAME</th>
<th>INVOICE NO.</th>
<th>NET INVOICE AMOUNT</th>
<th>STATE TAX AMOUNT</th>
<th>COUNTY TAX AMOUNT</th>
<th>SPECIAL COUNTY TAX</th>
<th>COUNTY PAID</th>
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</table>

**TOTAL**

I certify that the above listed vendors were paid sales tax upon purchases of materials during the period covered by the Construction Estimate, and the property upon which such taxes were paid with or will be used in the performance of this contract. No tax on purchases or rentals of tools and/or equipment is included in the above list. All of the materials above became a part of or is annexed to the building or structure being erected, altered or repaired.

---

**Contractor or Subcontractor Name (PRINT):**

**Signature:**

**Name (print):**

**Title:**

**SWORN AND SUBSCRIBED BEFORE**

ME THIS _____ DAY OF ________, ___.

**NOTARY PUBLIC**

MY COMMISSION EXPIRES ON:
North Carolina One Call Center, Inc.

North Carolina One Call Center, Inc., a non-profit organization funded by participating utility companies and municipalities in the interest of community and job safety and improved service through damage reduction to the utilities.

A ONE CALL TOLL FREE TELEPHONE NUMBER, 811 or 1-800-632-4949, PROVIDES AN AVENUE TO ALL OF THE PARTICIPATING MEMBERS FROM ANY POINT WITHIN THE STATE OF NORTH CAROLINA.

Anyone proposing to excavate, dig, bore, tunnel, blast or disturb the earth in any manner in which buried utilities may be damaged is requested to call the toll-free number between the hours of 6:00 a.m. and 10:00 p.m., Monday through Friday, forty-eight hours before starting the proposed work.

Within minutes of your telephone call, the participating members will be made aware of your plans and will be given pertinent information that has been provided by you about your planned work. You will be told the names of the participating members from whom you can expect a response - if there are buried facilities in the path of your activity, the route of the utilities will be staked and/or marked at no expense to you. If there are no facilities in the area of the planned work, you will be called or notified by a representative of a participating company accordingly.

Should a non-participating utility operator be serving your area, we recommend that you call them on an individual basis. All utility operators, whether company or municipality, will be provided an opportunity to become a member of North Carolina One Call Center, Inc.

Naturally, knowing the route of utilities, the excavator is expected to exercise caution and to avoid damage as the project progresses.

Damage prevention does not just happen – it is a planned and orderly process through which each of us can participate - YES, WE CAN AND WE WILL DRAMATICALLY REDUCE DAMAGES TO THE UTILITIES IN THE STATE OF NORTH CAROLINA!! THANKS FOR YOUR HELP.

BEFORE YOU DIG
IN THE INTEREST OF COMMUNITY AND JOB SAFETY AND IMPROVED SERVICE

CALL NORTH CAROLINA ONE CALL CENTER, INC.
811 or 1-800-632-4949

North Carolina One Call Center, Inc
2300 West Meadowview Rd., Suite 227
Greensboro, NC 27407
www.nc811.org
SECTION II

GENERAL CONDITIONS

Please reference online at:


Dated: 01/05/2010
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#### Corban Avenue Pump Station Rehabilitation

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<td>01105 Special Construction Conditions and Sequencing</td>
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<td>01700 Contract Closeout</td>
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<td>01781 Project Record Documents</td>
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<tr>
<td>01782 Operation and Maintenance Data</td>
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<td>02220 Excavation, Grading, Trenching, and Backfilling</td>
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<td>02230 Seeding</td>
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<th>PAGES</th>
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<tbody>
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<td>15060 Ductile Iron Pipe and Fittings</td>
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<tr>
<td>15444 Horizontal Split Case Pump and Motor</td>
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<td>16120 Wire and Cable</td>
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<td>16195 Identification for Electrical Systems</td>
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<td>16429 Generator Quick Connect Enclosure – Low Voltage</td>
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<td>16481</td>
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<tr>
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</tbody>
</table>
1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Work restrictions.
5. Specification and drawing conventions.

1.3 PROJECT INFORMATION

A. Project Identification:

1. Project Name: Corban Avenue Pump Station Rehabilitation
2. Project Location: Parcel Identification No. 56205468420000, Corban Avenue, Concord, NC 28026
3. Owner: City of City of Concord
4. Engineer: McKim & Creed, 8020 Tower Point Drive, Charlotte, NC 28227

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and generally consists of the following:

1. The Project generally consists of:

   a. Replacement of two (2) existing 15 HP horizontal split case pumps and motors with new 40 HP pumps and motors,
   b. Adjustments to existing suction and discharge piping related to pump replacements,
   c. Replacement of existing motor control center,
   d. Installation of two (2) new variable frequency drives for new pumps (provided by others),
   e. Installation of a new exterior portable generator connection
2. Project will be constructed under a single prime contract. Other work onsite shall include SCADA related improvements and programming of variable frequency drives, by others.

1.5 ACCESS TO SITE

A. Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work.

B. Use of Site: Limit use of Project site to construction limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated. Laydown and staging areas needs shall be coordinated with Owner.

C. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

D. Owner Occupancy: Do not close or obstruct occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction. Notify Owner not less than 48 hours in advance of activities that will affect Owner's operations.

1.6 WORK RESTRICTIONS

A. On-Site Work Hours: Limit work to normal business working hours Monday through Friday or as approved by the Owner.

B. Existing Utility Interruptions, Noise, Vibration, and Odors: Do not interrupt utilities serving facilities occupied by Owner or without coordination with Owner. Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption with Owner. Notify Owner not less than two days in advance, and obtain Owner’s written permission before proceeding with utility interruptions or disruptive operations.

C. Controlled Substances: Smoking is prohibited on site.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

A. Division 1 General Requirements: Requirements of Sections in Division 1 apply to the Work of all Sections in the Specifications.
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 Precedence

A. In resolving inconsistencies precedence shall be given in the following order: Agreement, Supplementary Conditions, General Conditions, Specifications – Division 01, Specifications – Divisions 02-16, and the construction drawings.

END OF SECTION 01010
SECTION 01021 – CONTINGENCY ALLOWANCE

PART 1 – GENERAL

General Construction Contingency Allowance: Included in the Base Bid Total, the Owner has established a Contingency Allowance for use upon Owner’s written instructions.

The Contingency Allowance shall be used at the sole discretion of the Owner, and may not be drawn upon without written approval of the Owner. This allowance is meant to cover small changes to the work that may occur from time to time during the construction period. The use of this allowance will be issued with a Work Change Directive (EJCDC C-940). The Work Change Directive must be approved by the Engineer, the Contractor, and the Owner.

Prior to final payment, an appropriate Change Order will be issued to reflect actual amounts due the Contractor on account of work authorized under the allowance, and the Contract Price shall be properly adjusted.

END OF SECTION 01021
SECTION 01105 – SPECIAL CONSTRUCTION CONDITIONS AND SEQUENCING

PART 1 – GENERAL

1.1 WORK INCLUDED

A. This section describes special construction conditions and sequencing for the Corban Avenue Pump Station Rehabilitation project.

B. The Contractor's progress schedule shall reflect the special construction conditions and sequencing covered in this section.

1.2 Water service will be maintained in continuous (uninterrupted) operation by the Owner during the entire construction period of the Contract as hereinafter specified. The intent of this section is to outline the minimum requirements necessary to provide continuous water service throughout the construction period.

1.3 The Contractor shall prepare a detailed construction plan for the work. The Contractor’s critical path or network schedule shall identify a milestone for tie-in, Engineer/Owner inspections, and commissioning of all major equipment/systems.

1.4 No interruption of water service shall be allowed. The Contractor shall provide all equipment and means to provide continuous water service, with at least one pump in operation, throughout the construction period.

1.5 In the event of an unscheduled interruption of service caused by the Contractor, the Contractor shall use all available resources and work continuously until service or operations are restored.

1.6 The area available for Contractor staging/storage is limited to the City of Concord’s fenced property. The Contractor shall coordinate the area for staging/storage completely with the Owner to ensure that no services or activities of the Owner are interrupted. Contractor is responsible for obtaining offsite staging/storage areas as required if the available existing area is insufficient for his activities.

1.7 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Submittals.

B. Submit to the Engineer a detailed construction plan as required in Section 01320 – Construction Progress Documentation.

PART 2 – PRODUCTS

2.1 The Contractor shall furnish all materials (both temporary and permanently installed) and equipment to execute tie-ins and bypasses.

2.2 The Owner shall be responsible for operating existing equipment and valves needed to facilitate all construction activities
PART 3 – EXECUTION

3.1 The Construction of the Corban Avenue Pump Station Rehabilitation shall follow the requirements outlined in this section. The Contractor is required to submit a sequence of construction for review and approval prior to work. A suggested sequence of construction is included in the plan set.

3.2 Field Measurements shall be taken by the Contractor as listed below to facilitate the planning and construction of the work.
   A. All dimensions and elevations shown on the plans are for reference only and the Contractor shall verify all relevant dimensions and elevations prior to starting construction, including ordering of materials.

3.3 TIME OF COMPLETION
   A. The time allowed for substantial completion of all work shall be one hundred and twenty (120) calendar days.
   B. Following the substantial completion, an additional thirty (30) days shall be allowed for final completion.
   C. Liquidated damages shall be as stated in the Agreement.

3.4 WARRANTY PERIOD
   A. The warranty period shall last for one (1) year from the date of Engineer’s verification of substantial completion of the entire Project.
   B. Upon completion of each phase of construction which is placed in service, Engineer shall conduct all observation, witness acceptance tests, and verify substantial completion of those portions of the plant necessary for operation.
   C. After the entire project has been verified to be substantially completed and placed in service, the warranty period shall begin such that there is only one warranty period for the entire Project.
   D. Prior to placing any portion of the facilities in service, Contractor shall deliver to Engineer the prescribed copies of O&M manuals; and shall have completed the required manufacturers’ training/startup.
   E. Any facilities which are damaged by the Contractor after substantial completion shall be repaired by Contractor. If damage is cosmetic, there will be no adjustment in the warranty period. If damage requires replacement of a significant item of process equipment, a new one (1) year warranty period shall be established.

3.5 SUBSIDIARY WORK
   A. All subsidiary work required to achieve Substantial Completion of each phase of construction shall be understood to be included whether referenced specifically or not.
B. All remaining work not specifically described above shall be completed within the overall time allowed for Substantial Completion of the project.

END OF SECTION 01105
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SECTION 01110 – ENVIRONMENTAL PROTECTION PROCEDURES

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work covered by this Section consists of furnishing all labor, materials and equipment and performing all work required for the prevention of environmental pollution in conformance with applicable laws and regulations, during and as the result of construction operations under this Contract. For the purpose of this Specification, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic or recreational purposes.

B. The control of environmental pollution requires consideration of air, water and land; and involves management of noise and solid waste, as well as other pollutants.

C. Schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the work. Provide erosion control measures such as diversion channels, sedimentation or filtration systems, berms, staked hay bales, seeding, mulching, or other special surface treatments as are required to prevent silting and muddying of streams, rivers, impoundments, lakes, etc. All erosion control measures shall be in place in an area prior to any construction activity in that area. Specific requirements for erosion and sedimentation controls are shown on the drawings and specified herein.

D. These Specifications are intended to ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and its surroundings. These are general guidelines. It is the Contractor’s responsibility to utilize the specific construction techniques as detailed herein and shown on the plans to meet these guidelines.

E. Where the water main is constructed in wetlands, as designated on the Drawings, special construction and restoration requirements shall be met as specified herein.

F. Where the water main is constructed in wooded areas, the removal of trees shall be strictly controlled; and trees to remain shall be carefully protected. The Contractor is advised that the tree protection requirements herein shall be enforced.

1.2 APPLICABLE REGULATIONS

A. Comply with all applicable Federal, State and local laws and regulations concerning environmental pollution control and abatement. Any violations of laws and fines imposed shall be the sole responsibility of the Contractor, including payment of fines.

B. Sedimentation and Erosion Control measures shall be provided in accordance with NCDEQ Erosion and Sediment Planning and Design Manual.
1.3 NOTIFICATIONS

A. The Engineer will notify the Contractor in writing of any noncompliance with the foregoing provisions or of any environmentally objectionable acts and corrective action to be taken. Failure of the Engineer to provide such notice shall not relieve the Contractor of his responsibility to comply with all applicable specification provisions, regulations, and laws. State or local agencies responsible for verification of certain aspects of the environmental protection requirements may notify the Contractor in writing of any noncompliance with State or local requirements. The Contractor shall, after receipt of such notice from the Engineer or from the regulatory agency, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Owner may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it is later determined that the Contractor was in compliance.

PART 2 – PRODUCTS.

Not Used

PART 3 – EXECUTION

3.1 EROSION AND SEDIMENTATION CONTROL

A. Refer to Section 02190 Erosion and Sedimentation Control for Construction.

3.2 PROTECTION OF LAND RESOURCES

A. Land resources within the project boundaries and outside the limits of permanent work shall be restored to a condition, after completion of construction, that will be aesthetically graded and completely vegetated outside of paved areas, and not detract from the appearance of the project. Confine all construction activities to the permanent rights-of-way and temporary rights-of-way shown on the Drawings.

B. The locations of the Contractor’s storage and other construction buildings required temporarily in the performance of the work shall be on sites off the work site or on cleared portions of the work site or areas to be cleared as shown on the Drawings, and shall require written approval of the Engineer, and shall not be within wetlands or floodplains. The preservation of the landscape shall be an imperative consideration in the selection of all sites and in the construction of buildings. Drawings showing the proposed site for storage facilities shall be submitted for approval of the Engineer.

C. If the Contractor proposes to construct temporary roads or embankments and excavations for plans and/or work areas, he shall submit the following for approval at least ten (10) days prior to scheduled start of such temporary work:

1. A layout of all temporary roads, excavations, and embankments to be constructed within the work area.
2. Details of temporary road construction.

3. Drawings and cross sections of proposed embankments and their foundations, including a description of proposed material.

4. A landscaping drawing showing the proposed restoration of the area. Removal of any trees and shrubs outside the rights-of-way shall not be allowed. The drawing shall also indicate location of required guard posts or barriers required to control vehicular traffic passing close to trees and shrubs to be maintained and undamaged. Restoration shall provide for the obliteration of construction scars as such; and shall provide for a natural appearing final condition of the area. Modification of the Contractor’s approved drawings shall be made only with the written approval of the Engineer. No unauthorized road construction, excavation or embankment construction, including disposal areas, will be permitted.

D. Remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess of waste materials, or any other vestiges of construction.

E. All debris and excess excavation shall be disposed of outside the work site except where Engineer specifically directs or allows onsite disposal.

3.3 PROTECTION OF TREES

A. Contractor shall limit clearing to the width necessary for construction.

B. Specimen trees located within the right-of-way shall be removed only after permission from the Engineer or Owner.

C. Make every effort to protect all trees, shrubs, ground cover, and other vegetation existing on the project site with the exception of that designated to be removed. At a minimum, protection shall be specified herein. Such trees shall be protected from stockpiling, material storage, vehicle parking, equipment operation, unnecessary cutting, breaking and skinning or roots and branches, and skinning and bruising of bark. The Contractor shall cooperate with the Engineer and shall modify tree protection measures as directed by the Engineer.

D. Trees shall be protected prior to any clearing or demolition work. Protection measures shall remain in place until all work in the area is complete, including restoration. Tree roots shall be pruned where directed by Engineer prior to installing protection systems. No roots within the limb radius shall be damaged unless approved by the Engineer. Limbs shall be pruned as directed.

E. Protect trees and vegetation, including roots, from:

1. Dumping of refuse.

2. Chemically injurious materials and liquids.

4. Continual puddling of water, flooding erosion, and excessive wetting and drying resulting from dewatering and other operations.

F. Individual tree protection systems shall comprise one of the following systems:

1. As shown by the detail in the Drawings.

2. Install 6-foot-high chain link fencing around the trees.

G. Operation of the individual tree protection systems shall include the following:

1. No foot traffic, equipment, or vehicles within the fence line or on the tree side of the sheeting system.

2. No excavation or materials of any type within the above limits.

3. No directed run-off, chemicals, oil, or erosion products within the above limits.

4. No equipment booms, buckets, or other protrusions within the above limits, or damage to any overhanging limbs. Limbs which interfere with the work shall be pruned as directed by the Engineer.

5. No damage to the roots, trunks, or limbs of any tree being protected. No soil compaction, disturbance, or decrease in aeration permeability within the above limits.

6. Limit all of the above outside of the above limits to the maximum limb radius of the trees.

H. Where tree limbs overhang the project and where pruning is directed, prune trees to ANSI A-300 standards to avoid breaking. Where directed by the Engineer, extend pruning operations to restore natural shape of tree. Cut branches and roots with sharp pruning instruments. Do not break, chop, or mutilate.

I. Water trees which are to remain to maintain their health during the course of the work as directed by the Engineer, until restoration is complete and groundwater conditions have restabilized. Maintain a watering schedule. Do not allow exposed roots to dry out before permanent backfill is placed; provide temporary earth cover, pack with wet peat moss or four layers of wet untreated burlap, and temporarily support and protect from damage until permanently relocated and covered with backfill.

J. Excavate within the drip lines of trees only where indicated and approved by the Engineer. Excavation shall be under the direction of the Engineer. Hand excavate using narrow tine spading forks to minimize damage to root systems where possible. If large, main lateral roots are encountered, expose beyond excavation limits as required to bend and relocate without breaking. Relocate roots in backfill areas where possible.
K. The Contractor shall not deface, injure, or remove trees or shrubs outside of the designated sewer rights-of-way and in other areas requiring earthwork for the construction of the new facilities, without prior approval. No ropes, cables, or guys shall be fastened to or attached to any existing trees for anchorage.

L. Any tree outside of the specified clearing area and any tree that is to be protected that is damaged by the Contractor’s equipment or operations shall be restored as nearly as possible to its original condition. The Engineer will decide what method of restoration shall be used and whether damaged trees shall be treated and healed or removed. Trees that are to remain, either within or outside established clearing limits, that are damaged by the Contractor and are beyond saving in the opinion of the Engineer, shall be removed and replaced. Dead and damaged trees shall be removed as directed by the Engineer. All scars made on trees by equipment, construction operations, or by the removal of limbs larger than one inch in diameter shall be repaired in a manner approved by the Engineer. All pruning shall be performed according to ANSI A-300 standards by experienced tree workers. Pruning shall be done from bucket trucks. Trees shall not be climbed.

M. For every tree designated to remain within the permanent or temporary rights-of-way or desirable specimens outside of the rights-of-way that is significantly damaged, and for every tree designated for protection which partially or completely dies or shows significant distress within two years following the work, the Contractor shall remove and replace the tree with a like-kind of tree of minimum 4-inch caliper DBH and pay damages to the Owner in the amount of $300 per inch diameter of the damaged trees. If a like-kind tree is not available in 4-inch caliper, the Engineer will select an alternate variety from the Oak family.

N. Ground elevations shall be returned to existing grades under and around all trees. All trees within and immediately adjacent to the permanent and temporary rights-of-way to remain, including existing and transplanted trees, shall be given a layer of wood chips 15 feet in diameter and six inches deep at the time of area restoration and seeding. The area under the wood chips out to the limb radius shall be fertilized on the ground surface with five pounds per 100 square feet of area of 10-10-10 fertilizer.

3.4 PROTECTION OF AIR QUALITY

A. Burning. The use of burning at the project site for the disposal of refuse and debris shall not be permitted.

B. Dust Control. The Contractor shall maintain all excavations, embankment, stockpiles, access roads, plant sites, waste areas, borrow areas, and all other work areas within or without the project boundaries free from dust by keeping the area wetted by sprinkling.

C. Sprinkling shall be repeated at such intervals as to keep all parts of the disturbed area damp at all times, and the Contractor shall have sufficient equipment on the job to accomplish this. Dust control shall be performed as the work proceeds, and whenever a dust nuisance or hazard occurs, as determined by the Engineer.

3.5 MAINTENANCE OF POLLUTION CONTROL FACILITIES DURING CONSTRUCTION
A. During the life of this Contract, operate and maintain all facilities provided for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created.

3.6 NOISE CONTROL

A. The Contractor shall make every effort to minimize noise caused by his operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise and in compliance with this section.

END OF SECTION 01110
SECTION 01152 – APPLICATION FOR PAYMENT

PART 1 – GENERAL

1.1 REQUIREMENTS INCLUDED

A. Submit Applications for Payment to the Engineer and Project Expediter in accordance with the schedule established by Conditions of the Contract and Agreement between Owner and Contractor.

1.2 RELATED WORK

A. Agreement between Owner and Contractor is included in Div 0.
B. Standard General Conditions of the Construction Contract are included in Div 0.
C. Contract Closeout Procedures is included in Section 01700.
D. Project Record Documents are included in Section 01781.
E. A go-by application for payment format (EJCDC) is included in Div. 0.

1.3 SUBMITTALS

A. Submit applications typed on forms provided by the Owner, Application for Payment, with itemized data typed on 8-1/2-inch by 11-inch or 8-1/2-inch by 14-inch white paper continuation sheets.

B. Provide itemized data on continuation sheet:
   1. Format, schedules, line items, and values: Those of the Schedule of Values accepted by the Engineer.

C. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of values.
   3. Contractor's construction schedule.
   4. Schedule of unit prices.
   5. Submittal schedule.
   6. List of Contractor's staff assignments.
   7. List of Contractor's principal consultants.


10. Certificates of insurance and insurance policies.

1.4 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

A. Application Form:

1. Fill in required information, including that for Change Orders executed prior to date of submittal of application.

2. Fill in summary of dollar values to agree with respective totals indicated on continuation sheets.

3. Execute certificate with signature of a responsible officer of Contract firm.

B. Continuation Sheets:

1. Fill in total list of all scheduled component items of Work, with item number and scheduled dollar value for each item.

2. Fill in dollar value in each column for each scheduled line item when work has been performed or products stored.

   a) Round off values to nearest dollar, or as specified for Schedule of Values.

3. List each Change Order executed prior to date of submission, at the end of the continuation sheets.

   a) List by Change Order Number and description, as for an original component item of work.

4. To receive approval for payment on component material stored onsite, submit a detailed list of the materials or equipment and supporting copies of the original paid invoices with an application for payment. Refer to Section II General Conditions paragraph 14.2.1.3 for details.

1.5 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

A. When the Owner or the Engineer requires substantiating data, Contractor shall submit suitable information, with a cover letter identifying:

1. Project.

2. Application number and date.

3. Detailed list of enclosures.
4. For stored products:
   a) Item number and identification as shown on application.
   b) Invoice with cost.

B. Submit one copy of data and cover letter for each copy of application.

C. As a prerequisite for payment, Contractor shall submit a “Surety Acknowledgment of Payment Request” letter showing amount of progress payment which the Contractor is requesting.

D. The Contractor shall maintain an updated set of drawings to be used as record drawings in accordance with Section 01720. As a prerequisite for monthly progress payments, the Contractor is to exhibit the updated record drawings for review by the Owner and the Engineer.

E. The Contractor shall submit a Tax Statement and Certification with each application for payment, original signed in blue ink, on the forms provided.

F. Contractor’s progress schedule shall be up to date and complete as specified as a prerequisite for payment.

G. All time extension requests due to inclement weather shall be submitted and approved by the City Manager prior to extending the contract time.

1.6 SUBSTANTIAL COMPLETION

A. After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   
   2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

1.7 PREPARATION OF APPLICATION FOR FINAL PAYMENT

A. Fill in Application form as specified for progress payments.

B. Use continuation sheet for presenting the final statement of accounting as specified in Section 01700 – Contract Closeout.

C. Submit all Project Record Documents in accordance with Section 01781.

1.8 SUBMITTAL PROCEDURE

A. Submit Applications for Payment to the Engineer at the times stipulated in the Agreement.
B. Number: Five (5) copies of each Application.

C. When the Engineer finds that the Application has been properly completed and correct, he/she will transmit certificate for payment to Owner, with one copy to Contractor.

D. Applications for payment will not be paid if the Contractor does not have an updated schedule for the basis of payment and all Record Drawings are up to date and complete.

1.8 SCHEDULE OF VALUES

A. Coordination: Contractor to coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Correlate line items in the schedule of values with other required administrative forms and schedules, including the following:

   a) Application for Payment forms with continuation sheets.

   b) Submittal schedule.

   c) Items required to be indicated as separate activities in Contractor's construction schedule. Revise seven-day time period in first subparagraph below to suit Project.

2. Submit the schedule of values to Engineer at earliest possible date but no later than 14 days before the date scheduled for submittal of initial Applications for Payment.

3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. Format and Content: Use the Bid Form as a guide to establish line items for the schedule of values.

1. Identification: Include the following Project identification on the schedule of values:

   a) Project name and location.

   b) Name of Engineer.

   c) Engineer's project number.

   d) Contractor's name and address.

   e) Date of submittal.

2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.
3. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

5. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a) Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

8. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

END OF SECTION 01152
SECTION 01153 – CHANGE ORDER PROCEDURES

PART 1 – GENERAL

1.1 REQUIREMENTS INCLUDED

A. Promptly implement change order procedures.
   1. Provide full written data required to evaluate changes.
   2. Maintain detailed records of work done on a time-and-material/force account basis.
   3. Provide full documentation to Engineer on request.

B. Designate in writing the member of Contractor’s organization:
   1. Who is authorized to accept changes in the Work.
   2. Who is responsible for informing others in the Contractor’s employ of the authorization of changes in the Work.

C. Owner will designate in writing the person who is authorized to execute Change Orders.

1.2 RELATED REQUIREMENTS

A. Agreement and the amounts of established unit prices, is included in Div. 0.
B. Conditions of the Contract are included in Div. 0.
   1. Methods of determining cost or credit to Owner resulting from changes in Work made on a time and material basis.
   2. Contractor’s claims for additional costs.
C. Applications for Payment are included in Section 01152.
D. Construction Schedules are included in Section 01320.
E. Project Record Documents are included in Section 01781.

1.3 DEFINITIONS

A. Change Order: See General Conditions of Contract.
B. Construction Change Authorization: A written order to the Contractor, signed by Owner and Engineer, which amends the Contract Documents as described, and authorizes Contractor to proceed with a change which affects the Contract Sum or the Contract Time, for inclusion in a subsequent Change Order.
C. Field Order: A written order to the Contractor, signed by the Engineer and the Contractor, which is issued to interpret/clarify the Contract Documents, order minor changes in the work, or memorialize trade-off agreements. The work described by a Field Order is to be accomplished without change to the Contract Sum, Contract Time, or claims for other costs.

1.4 PRELIMINARY PROCEDURES

A. Owner or Engineer may initiate changes by submitting a Request for Proposal (RFP) to Contractor. Request will include:

1. Detailed description of the Change, Products, and location of the change in the Product.

2. Supplementary or revised Drawings and Specifications.

3. The projected time span for making the change and a specific statement as to whether overtime is or is not authorized.

4. A specific period of time during which the requested price will be considered valid.

5. Such request is for information only and is not an instruction to execute the changes, nor to stop work in progress.

B. Contractor may initiate changes by submitting a written notice to Engineer, containing:

1. Description of the proposed changes.

2. Statement of the reason for making the changes.


4. Statement of the effect on the work of separate contractors.

5. Documentation supporting any change in Contract Sum or Contract Time, as appropriate.

1.5 WORK CHANGE DIRECTIVE AUTHORIZATION

A. Contractor shall use the City of Concord’s Contract Change Order Form from Section I of these specifications.

B. In lieu of a Request for Proposal (RFP), Engineer may issue a work change directive authorization for Contractor to proceed with a change for subsequent inclusion in a Change Order.

C. Authorization will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change; and will designate a method of determining any change in the Contract Sum and any change in Contract Time.
D. Owner and Engineer will sign and date the Work Change Directive Authorization as authorization for the Contractor to proceed with the changes.

E. Contractor may sign and date the Work Change Directive Authorization to indicate agreement with the terms therein.

1.6 DOCUMENTATION OF PROPOSALS AND CLAIMS

A. Support each quotation for a lump sum proposal and for each unit price which has not previously been established, with sufficient substantiating data to allow Engineer to evaluate the quotation.

B. On request, provide additional data to support time and cost computations.
   1. Labor required.
   2. Equipment required.
   3. Products required.
      a) Recommended source of purchase and unit cost.
      b) Quantities required.
   4. Taxes, insurance and bonds.
   5. Credit for work deleted from Contract similarly documented.
   6. Overhead and profit.
   7. Justification for any change in Contract Time based upon impact to the approved, current project schedule. The Owner owns all float.

C. Support each claim for additional costs and for work done on a time-and-material/force account basis, with documentation as required for a lump sum proposal, plus additional information.
   1. Name of the Owner’s authorized agent who ordered the work, and date of the order.
   2. Dates and times work was performed, and by whom.
   3. Time record, summary of hours worked, and hourly rates paid.
   4. Receipts and invoices for:
      a) Equipment used, listing dates and times of use.
      b) Products used, listing of quantities.
      c) Subcontracts.
1.7 PREPARATION OF CHANGE ORDERS AND FIELD ORDERS

A. Engineer will prepare each Change Order and Field Order.

B. Change Order will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change.

C. Change Order will provide an accounting of the adjustment in the Contract Sum and in the Contract Time.

D. Field Order will describe interpretations or clarifications of Contract Documents, order minor changes in the Work, or memorialize trade-off agreements.

E. Field Order work will be accomplished without change in the Contract Sum, Contract Time, or claims for other costs.

1.8 LUMP SUM / FIXED PRICE CHANGE ORDER

A. Content of Change Orders will be based on either:
   1. Engineer’s Proposal Request and Contractor’s responsive Proposal as mutually agreed between Owner and Contractor; or
   2. Contractor’s Proposal for a change, as recommended by Engineer.

B. Owner and Engineer will sign and date the Change Order as authorization for the Contractor to proceed with the changes.

C. Contractor will sign and date the Change Order to indicate agreement with the terms therein.

1.9 UNIT PRICE CHANGE ORDER

A. Content of Change Orders will be based on either:
   1. Engineer’s definition of the scope of the required changes;
   2. Contractor’s Proposal for a change, as recommended by Engineer; or
   3. Survey of completed work.

B. The amounts of the unit prices to be:
   1. Those stated in the Agreement.
   2. Those mutually agreed upon between Owner and Contractor.

C. When quantities of each of the items affected by the Change Order can be determined prior to start of the work:
1. Owner and Engineer will sign and date the Change Order as authorization for Contractor to proceed with the changes.

2. Contractor will sign and date the Change Order to indicate agreement with the terms therein.

D. When quantities of the items cannot be determined prior to the start of the work:

1. Engineer or Owner will issue a construction change authorization directing Contractor to proceed with the change on the basis of unit prices, and will cite the applicable unit prices.

2. At completion of the change, Engineer will determine the cost of such work based on the unit prices and quantities used.
   - a) Contractor shall submit documentation to establish the number of units of each item and any claims for a change in Contract Time.

3. Engineer will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.

4. Owner and Contractor will sign and date the Change Order to indicate their agreement with the terms therein.

1.10 TIME AND MATERIAL / FORCE ACCOUNT CHANGE ORDER / WORK DIRECTIVE CHANGE AUTHORIZATION

A. Engineer and Owner will issue a work Directive Change Authorization directing Contractor to proceed with the changes.

B. At completion of the change, Contractor shall submit itemized accounting and supporting data as provided in the Article “Documentation of Proposals and Claims” of this Section.

C. Engineer will determine the allowable cost of such work, as provided in General Conditions and Supplementary Conditions.

D. Engineer will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.

E. Owner and Contractor will sign and date the Change Order to indicate their agreement therewith.

1.11 CORRELATION WITH CONTRACTOR’S SUBMITTALS

A. Periodically revise Schedule of Values and Request for Payment forms to record each change as a separate item of Work, and to record the adjusted Contract Sum.

B. Periodically revise the Construction Schedule to reflect each change in Contract Time.
1. Revise sub-schedules to show changes for other items of work affected by the changes.

C. Upon completion of work under a Change Order, enter pertinent changes in Record Documents.

PART 2 – PRODUCTS.

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01153
SECTION 01200 – PROJECT MEETINGS

PART 1 – GENERAL

1.1 REQUIREMENTS INCLUDED

A. The Engineer shall schedule and administer preconstruction meeting, monthly progress meetings, and specially called meetings throughout progress of the Work.

1. Prepare agenda for meetings.
2. Make physical arrangements for meetings.
3. Preside at meetings.
4. Record the minutes; include significant proceedings and decisions.
5. Reproduce and distribute copies of minutes after each meeting.
   a) To participants in the meeting.
   b) To parties affected by decisions made at the meeting.

B. Representatives of Contractors, subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. The Contractor and his onsite superintendent shall attend meetings to ascertain that work is expedited consistent with Contract Documents and construction schedules.

1.2 RELATED REQUIREMENTS

A. Instructions to Bidders are included in Div. 0.
B. Construction Schedules are included in Section 01320.
C. Shop Drawings, Working Drawings and Samples are included in Section 01330.
D. Project Record Documents are included in Section 01781.

1.3 PRE-CONSTRUCTION MEETING

A. The Engineer shall schedule a preconstruction meeting at any time after Notice of Award, but no later than 15 days after date of Notice to Proceed.

B. Location: A central site, convenient for all parties, designated by the Owner.

C. Attendance:
   1. Owner’s Representative.
2. Engineer and his/her professional consultants.
3. Resident Project Representative.
4. Contractor’s Superintendent.
5. Major Subcontractors.
6. Major suppliers.
7. Utilities.
8. Others as appropriate.

D. Suggested Agenda:
1. Distribution and discussion of:
   a) List of major subcontractors and suppliers.
   b) Projected Construction Schedules.
2. Critical work sequencing.
3. Major equipment deliveries and priorities.
4. Project Coordination.
   a) Designation of responsible personnel.
5. Procedures and processing of:
   a) Field decisions.
   b) Proposal requests.
   c) Submittals.
   d) Change Orders.
   e) Applications for Payment.
7. Procedures for maintaining Record Documents.
8. Use of premises:
   a) Office, work, and storage areas.
   b) Owner’s requirements.
10. Temporary utilities.
11. Housekeeping procedures.

1.4 PROGRESS MEETINGS

A. Schedule regular periodic meetings. The progress meetings will be held approximately every 30 days with the first meeting approximately 30 days after the preconstruction meeting, or approximately 30 days after the date of Notice to Proceed.

B. Hold called meetings as required by progress of the Work.

C. Location of the meetings: Project field office of Contractor or at Owner’s office.

D. Attendance:

1. Owners Representative
2. Engineer and his/her professional consultants as needed.
3. General Contractor and onsite superintendent.
4. Electrical Contractor.
5. Subcontractors as appropriate to the agenda.
6. Suppliers as appropriate to the agenda.
7. Others as appropriate.

E. Suggested Agenda:

1. Review and approval of minutes of previous meeting.
2. Review of work progress for the last 30 days using the approved current CPM schedule. The General Contractor shall present a status report of the project with input from the other Prime Contractors seven days prior to the scheduled meeting.
3. Field observations, problems, conflicts.
4. Problems which impede Construction Schedule.
5. Review of offsite fabrication, delivery schedules.
6. Corrective measures and procedures to regain projected schedule.
7. Revisions to Construction Schedule.
8. Progress, schedule, during succeeding work period using the 30-day look-ahead schedule prepared by the General contractor.

9. Coordination of schedules.

10. Review submittal schedules; expedite as required.


12. Pending changes and substitutions.

13. Review proposed changes for:
   a) Effect on Construction Schedule and on completion date.
   b) Effect on other contracts of the Project.


15. Critical/long lead items.

16. Other business.

F. The Contractor and his superintendent are to attend progress meetings, and are to study previous meeting minutes and current agenda items in order to be prepared to discuss pertinent topics such as deliveries of materials and progress of the Work, etc.

G. The Contractor is to provide a current submittal log at each progress meeting in accordance with Section 01330.

PART 2 – PRODUCTS.

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01200
SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
      1. General project coordination and administrative procedures.
      2. Key personnel.
      3. Requests for Information (RFIs).
   B. Related Sections:
      1. Section 01320 "Construction Progress Documentation".
      2. Section 01700 "Contract Closeout".

1.3 COORDINATION
   A. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
      1. Preparation of Contractor's construction schedule, and schedule of values.
      2. Delivery and processing of submittals.
      3. Progress meetings.
      4. Startup and adjustment of systems.
      5. Project closeout activities.

1.4 KEY PERSONNEL
   A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including office, and cellular telephone numbers and email addresses.
1.5 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI using EJCDC Forms acceptable to the Engineer.

1. Engineer will return RFIs submitted to Engineer by entities other than the Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to prevent delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Date, project name & project number
2. Name of Contractor and Engineer.
3. RFI number, numbered sequentially; and RFI subject.
4. Drawing number and/or Specification Section number, as appropriate.
5. Field dimensions and conditions, as appropriate.
6. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
7. Contractor's signature.
8. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. Engineer’s Action: Engineer will review each RFI, determine action required, and respond. Allow fifteen working days for Engineer’s response for each RFI. RFIs received by Engineer after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:
   a. Requests for approval of submittals or substitutions.
   b. Requests for information already indicated in the Contract Documents.
   c. Requests for adjustments in the Contract Time or the Contract Sum.
   d. Requests for interpretation of Engineer's actions on submittals.
   e. Incomplete RFIs or inaccurately prepared RFIs.

2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt of additional information.
3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Change Order Procedures."
   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within 10 days of receipt of the RFI response.

D. On receipt of Engineer’s action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within 7 days if Contractor disagrees with response.
E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log at monthly progress meetings with the following information:

1. Project name.
2. Name and address of Contractor and Engineer.
3. RFI number including RFIs that were dropped and not submitted.
4. RFI description, date the RFI was submitted and date Engineer’s response was received.
5. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310
SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Promptly after award of the Contract and within ten days after the effective date of the Agreement, prepare and submit to the Engineer estimated construction progress schedules for the Work, with sub-schedules of related activities which are essential to its progress.

B. The Contractor shall submit revised progress schedules monthly with Application for Payment.

C. No partial payments shall be approved by the Engineer until there is an up-to-date construction progress schedule on hand.

D. The construction schedule shall in general determine the order in which the work is to proceed. The Engineer, however, may order and authorize minor changes of this schedule whenever such changes are of definite advantage to the Owner or necessary for the operations of the Owner.

E. The Contractor shall designate an authorized representative of his firm who shall be responsible for development and maintenance of the schedule and of progress and payment reports. This representative of the Contractor shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the commitments of the Contractor’s schedule.

1.2 RELATED REQUIREMENTS

A. General Conditions – Div. 0.

B. Supplementary General Conditions – Div. 0.

C. Section 01010: Summary of Work.

D. Section 01200: Project Meetings.

E. Section 01340: Submittals.

1.3 FORM OF SCHEDULES

A. Prepare schedules in the form of a horizontal bar chart.
   1. Provide separate horizontal bar for each trade or operation within each structure or item.
   2. Horizontal time scale: In weeks from start of construction and identify the first work day of each month.
   3. Scale and spacing: To allow space for notations and future revisions.

B. Format of listings: The chronological order of the start of each item of work and for each structure.
C. Identification of listings: By major specification section numbers if applicable.

1.4 CONTENT OF SCHEDULES

A. Construction Progress Schedule:
   1. Show the complete sequence of construction by activity.
   2. Show the dates for the beginning and completion of each major element of construction in no more than a two-week increment scale.
   3. Show projected percentage of completion for each item, as of the first day of each month.
   4. Show projected dollar cash flow requirements for each month of construction.

B. Submittals Schedule for Shop Drawings and Samples in accordance with Section 01340. Show:
   1. The dates for Contractor’s submittals.
   2. The dates that submittals shall be required from the Engineer.

C. A typewritten list of all long lead items (equipment, material, etc.)

1.5 PROGRESS REVISIONS

A. Indicate progress of each activity to date of submission.

B. Show changes occurring since previous submission of schedule:
   1. Major changes in scope.
   2. Activities modified since previous submission.
   3. Revised projections of progress and completion.
   4. Other identifiable changes.

C. Provide a narrative report as needed to define:
   1. Problem areas, anticipated delays, and the impact on the schedule.
   2. Corrective action recommended, and its effect.
   3. The effect of changes on schedules of other prime contractors.

1.6 SUBMITTALS

A. Format for Submittals: PDF electronic file and two paper copies.

B. Submit to the Engineer Start-up construction schedules within seven (7) days of date established for the Notice to Proceed.
1. Engineer shall review schedules and return review copy within 21 days after receipt.

2. If required, resubmit within seven days after return of review copy.

C. Submit revised monthly progress schedules with that month’s application for payment as required by the Engineer.

D. Daily Construction Reports: Submit at weekly intervals.

E. Field Condition Reports: Submit at time of discovery of differing conditions.

1.7 QUALITY ASSURANCE

A. Provide preliminary schedule at preconstruction conference per Section 01310 – Project Management and Coordination. Identify any constraints, long-lead items, and procedures for updating the schedule.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from Notice to Proceed to date of final completion.

B. Activities: Comply with the following:

   1. Procurement Activities: Include procurement process activities for the long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

   2. Submittal Review Time: Include review and resubmittal times indicated in this specification and Section 01330 – Submittal Procedures in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.

   3. Startup and Testing Time: The contractor shall include four (4) occurrences for the pump system supplier to be on site for the installation, start-up, and testing for pump and AC drive installation, and one (1) occurrence for start-up and testing of the completed pump system.

   4. Milestones: To include, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

2.2 START-UP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit start-up horizontal bar-chart-type construction schedule within 7 days of date established for the Notice to Proceed. Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 30 days of construction.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)
A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, construction schedule within 30 days of the Notice to Proceed. Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

2.4 UPCOMING WORK SUMMARY

A. Prepare a brief summary indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered RFIs.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.

B. This shall be submitted electronically via email to Engineer and Owner.

2.5 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events.
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Work Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.
PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have occurred. Issue updated schedule concurrently with the report of each such meeting.

2. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, the job site file, and other parties identified by Contractor with a need-to-know schedule responsibility.

3.2 RESPONSIBILITY FOR SCHEDULE COMPLIANCE

A. The Contractor agrees that whenever it becomes apparent from the current monthly schedule that delays have resulted and that the Contract completion date shall not be met or when so directed by the Engineer, he shall take some or all of the following actions at no additional cost to the Owner, submitting to the Engineer for approval, a written statement of the steps he intends to take to remove or arrest the delay to the current schedule.

B. Increased construction manpower in such quantities and crafts as shall substantially eliminate, in the judgment of the Engineer, the backlog of work.

C. Increase the number of working hours per shift, shifts per working days per week, the amount of construction equipment, or any combination of the foregoing, sufficiently to substantially eliminate, in the judgment of the Engineer, the backlog of work.

D. Reschedule activities to achieve maximum practical concurrency of accomplishment of activities, and comply with the revised schedule.

3.3 ADJUSTMENT OF CONTRACT SCHEDULE AND COMPLETION TIME

A. If the Contractor desires to make changes in his method of opening which affect the current schedule, he shall notify the Engineer in writing stating what changes are proposed and the reason for the change. If the Engineer agrees to the changes, the Contractor shall revise and submit for review, without additional cost to the Owner, all of the affected portions of the schedule. The schedule shall be adjusted by the Contractor only after the Engineer agrees to the proposed changes.

B. Adjustments may consist of changing portions of the activity sequence or activity durations, division of activities, or other adjustments as may be acceptable by the Engineer. The addition of extraneous, nonworking activities or activities which add unacceptable restraints to the schedule shall not be agreed to.

C. If the completion of any activity, whether or not critical, falls more than 100% behind its duration, the Contractor shall submit for review a schedule adjustment showing each activity divided into two activities reflecting completed versus uncompleted work.
D. Shop drawings which are not approved on the first submittal or within the scheduled time shall be immediately rescheduled, as well as pipelines which do not pass leak tests.

E. The Contract completion time shall be adjusted only for causes specified in this Contract. In the event the Contractor requests an extension of any Contract completion date, he shall furnish such justification and supporting evidence as the Engineer may deem necessary for a determination as to whether the Contractor is entitled to an extension of time under the provisions of this Contract. Engineer shall, after receipt of such justification and supporting evidence, make findings of fact and shall advise the Contractor in writing thereof. If the Engineer finds that the Contractor is entitled to any extension of any Contract completion date under the provision of this Contract, the Engineer’s determination as to the total number of days extension shall be based upon the current schedule and all data relevant to the extension. Such data shall be included in the next monthly updating of the schedule.

F. From time to time it may be necessary for the Contract schedule or completion time to be adjusted by the Engineer to reflect the effects of job conditions, technical difficulties, strikes, unavoidable delays on the part of the Owner or his representatives, and other unforeseeable conditions which may indicate schedule adjustments or completion time extension. Under such conditions, the Contractor shall reschedule the work or Contract completion time to reflect the changed conditions, and the Contractor shall revise his schedule accordingly. No additional compensation shall be made to the Contractor for such schedule changes except for unavoidable overall Contract time extensions beyond the actual completion of all unaffected work in the Contract, in which case the Contractor shall take all possible action to minimize any time extension and any additional cost to the Owner. It is specifically pointed out that the use of available float time in the schedule may be used by the Owner as defined by the Engineer, as well as by the Contractor. Float time is defined as the amount of time between the early start date and the late start date, or the early finish date and the late finish date, or any of the activities in the schedule.

G. The Owner controls the float time in the current schedule and therefore without obligation to extend either the overall completion date of any intermediate completion dates set out in the schedule, the Owner may initiate changes to the contract work that absorb float time only. Contractor-initiated changes that encroach on the float time identified in the current schedule may be accomplished with the Owner’s concurrence. Such changes, however, shall give way to Owner-initiated changes competing for that same float time.

3.4 COORDINATING SCHEDULES WITH OTHER CONTRACT SCHEDULES

A. Where work is to be performed under this Contract concurrently with or contingent upon work performed on the same facilities or area under other contracts, the Contractor’s schedules shall be coordinated with the schedules of the other contracts. The Contractor shall obtain the schedules of the other appropriate contracts from the Engineer for the preparation and updating of his schedule and shall make the required changes in his schedules when indicated by changes in corresponding schedules.

END OF SECTION 01320
SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY, RELATED DOCUMENTS AND RELATED SECTIONS

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, and other submittals.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

C. Related Sections:
   1. General Conditions Section "Payment Procedures"
   2. Section 01340 "Submittals"
   3. Section 01781 "Project Record Documents"
   4. Section 01782 "Operation and Maintenance Data"

1.2 SUBMITTAL SCHEDULE

A. Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Engineer and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
4. Format: Arrange the following information in a tabular format:
   a. Scheduled date for first submittal.
   b. Specification Section number and title.
   c. Name of subcontractor.
   d. Narrative Description of the Work covered.
   e. Scheduled date for Engineer’s final release or approval.
   f. Scheduled dates for purchasing and installation.
   g. Activity or event number.
1.3 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
4. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineers receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow fifteen (15) days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
2. Resubmittal Review: Allow 7 days for review of each resubmittal.
3. Sequential Review: Where sequential review of submittals by Engineer's consultants, Owner, or other parties is indicated, allow 14 days for initial review of each submittal.

C. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
3. Include the following information for processing and recording action taken:
   a. Date and Project name.
   b. Name of Engineer, Construction Manager, Contractor, subcontractor, supplier, and manufacturer.
   c. Submittal number or other unique identifier, including revision identifier. Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).
   d. Number and title of appropriate Specification Section and/or drawing number.
   e. Location(s) where product is to be installed, as appropriate.
   f. Brief narrative description of item or equipment.

D. Options: Identify options requiring selection by the Engineer.

E. Deviations: Identify deviations from the Contract Documents on submittals.
F. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Engineer will return submittals, without review received from sources other than Contractor.

1. Transmittal Form: Provide a form that includes date, project name, destination (To), source (from), subject, and signature of transmitter.

2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal and current revision in label or title block, and clearly indicate extent of revision.

2. Resubmit submittals until they are marked with “no exceptions taken” notation from Engineer's action stamp.

H. Distribution: Furnish two paper copies of final submittals to Owner. Furnish additional copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Use only final submittals that are marked with “no exceptions taken” notation from Engineer's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections.

1. Submit 5 paper copies, and one electronic copy in .pdf format, of each submittal, unless otherwise indicated. Engineer will return 4 copies.

2. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 1 Section "Closeout Procedures."

3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale, per the requirements of Section 01340 Submittals.

C. Contractor's Construction Schedule per Specification "Construction Progress Documentation."
D. Application for Payment per General Conditions Section "Payment Procedures."

E. Schedule of Values per General Conditions Section "Payment Procedures."

F. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

G. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

H. Product and Material Certificates: Submit written statements on manufacturer's letterhead certifying that products and materials complies with requirements in the Contract Documents.

I. Maintenance Data: Submit draft O&M Manuals with initial product submittal.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer. If Contractor stamps submittal indicating it meets the project specifications and the submittal does not meet project specifications, the Engineer will charge the Contractor the cost to review the submittal.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ENGINEER’S ACTION

A. General: Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action required.

C. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

END OF SECTION 01330
SECTION 01340 – SUBMITTALS

PART 1 - GENERAL

1.1 Before any work is started at the job site, the Contractor shall make submittals to the Engineer in accordance with the requirements of this section. The Contractor shall be responsible for preparing a progress or work schedule for the project awarded. The Contractor shall process the shop drawings for all materials required by his work to the Engineer and he shall be responsible for their timely submission in accordance with the shop drawing schedule which is included in the overall progress or work schedule as described in this section.

1.2 SUBMITTALS

A. Submittals are defined as shop drawings, diagrams, illustrations, schedules, performance charts, brochures and other data prepared by each contractor which illustrate how specific portions of the work shall be fabricated and/or installed. Submittals and shop drawings are not part of the Contract Documents, but are a supplementary means of communications to assist in understanding what each Contractor proposes to provide and to establish whether or not what he intends to install conforms to the drawing and specifications.

B. In the instance of a substituted item, the Contractor shall verify that it will fit into the space allocated to the originally required item giving due regard to all other trades' requirements. Where modifications to the Plans and Specifications are proposed, the Contractor must indicate such deviation in writing in his submittal.

1.3 SUBMITTAL PROCEDURES

A. Shall be per Section 01330

1.4 DRAWINGS

A. Only drawings which have been checked or corrected by the fabricator should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter conforms to the Plans and Specifications in all respects. Drawings which are correct shall be marked with the date, checker's name and certification of the Contractor's approval, and then shall be submitted to the Engineer. Any shop drawings submitted without the Contractor's certification will be returned without review.

B. The following information shall be provided with each submittal: A copy of the relevant specification section, with addendum updates included, with each paragraph check-marked (✓) to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the
right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specifications sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

C. Shop drawings shall show the principal dimensions, weight and structural and operating features, performance characteristics and wiring and control diagrams, space required, clearances, 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 or fabricator as correct.

D. When so specified or if considered by the Engineer to be acceptable, manufacturer's specifications, catalog data, descriptive matter, illustrations, etc., may be submitted for review in place of shop and working drawings. In such case, the requirements shall be as specified for shop and working drawings, insofar as possible.

E. The Contractor shall be responsible for the prompt submission of all shop and working drawings in accordance with the shop drawing schedule so that there shall be no delay to the work due to the absence of such drawings.

F. No material shall be purchased or fabricated until the required shop and working drawings have been submitted and reviewed. All materials and work involved in the construction shall then be as represented by said drawings.

G. The Engineer's review of shop and working drawings will follow a general check made to ascertain conformance with the design concept and functional result of the project and compliance with the information given in the Plans and Specifications. The Contractor is responsible for details and accuracy, for conforming and correlating all quantities and dimensions at the job site; for information that pertains to the fabrication processes or to techniques of construction; for coordination of the work of all trades; and for timely delivery of all materials so that the project will not be delayed.

1.5 PAYMENT FOR SUBMITTALS

A. Submittals are considered subsidiary to the contract and, therefore shall be performed at no extra cost.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01340
SECTION 01400 – QUALITY CONTROL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality-control services.

B. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Engineer.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.

1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.

3. Requirements for Contractor to provide quality-control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

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

1. Division 1 Section 01330 Submittals specifies requirements for development of a schedule of required tests and inspections.

2. Divisions 2 through 16 Sections for specific test and inspection requirements.

1.3 RESPONSIBILITIES

A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality-control

services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services are included in the Contract Sum.

1. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are to be included in the Contract Sum.

2. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Owner's responsibility, the Contractor will employ and pay an Owner selected qualified independent testing agency to perform those services. A Contract Allowance will be provided by the Owner for payment of those services. The Contractor shall assist the Owner by providing men and equipment for excavation of test pits, excavation for test pads for density tests and moving testing equipment around the project site.

B. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.

1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements. The cost to repair, rework, or replace material or work indicated noncompliance shall be born by the Contractor.

C. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:

1. Provide access to the Work.
2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
4. Provide facilities for storage and curing of test samples.
5. Deliver samples to testing laboratories.
6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
7. Provide security and protection of samples and test equipment at the Project Site.
D. Duties of the Testing Agency: The independent agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Engineer and the Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Engineer and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.

3. The agency shall not perform any duties of the Contractor.

E. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.4 SUBMITTALS

A. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Engineer. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.

1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

2. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:

   a. Date of issue.

   b. Project title and number.

   c. Name, address, and telephone number of testing agency.

   d. Dates and locations of samples and tests or inspections.

   e. Names of individuals making the inspection or test.

   f. Designation of the Work and test method.

   g. Identification of product and Specification Section.
h. Complete inspection or test data.

i. Test results and an interpretation of test results.

j. Ambient conditions at the time of sample taking and testing.

k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.

l. Name and signature of laboratory inspector.

m. Recommendations on retesting.

1.5 QUALITY ASSURANCE

A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.

1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

3.1 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Protect construction exposed by or for quality-control service activities, and protect repaired construction.

B. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 01400
SECTION 01420 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if
bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Name</th>
<th>Telephone Number</th>
<th>Web Site</th>
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<tbody>
<tr>
<td>AISC</td>
<td>American Institute of Steel Construction</td>
<td>(800) 644-2400</td>
<td><a href="http://www.aisc.org">www.aisc.org</a></td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
<td>(202) 293-8020</td>
<td><a href="http://www.ansi.org">www.ansi.org</a></td>
</tr>
<tr>
<td>API</td>
<td>American Petroleum Institute</td>
<td>(202) 682-8000</td>
<td><a href="http://www.api.org">www.api.org</a></td>
</tr>
<tr>
<td>ASME</td>
<td>ASME International (American Society of Mechanical Engineers International)</td>
<td>(800) 843-2763 (973) 882-1170</td>
<td><a href="http://www.asme.org">www.asme.org</a></td>
</tr>
</tbody>
</table>
ISO  International Organization for Standardization  41 22 749 01 11
www.iso.ch

NEMA  National Electrical Manufacturers Association  (703) 841-3200
www.nema.org

NFPA  NFPA  (National Fire Protection Association)  (800) 344-3555
(617) 770-3000
www.nfpa.org

SSPC  SSPC:  The Society for Protective Coatings  (877) 281-7772
www.sspc.org  (412) 281-2331

UL  Underwriters Laboratories Inc.  (877) 854-3577
www.ul.com  (847) 272-8800

C.  Code Agencies:  Where abbreviations and acronyms are used in Specifications or other Contract
Documents, they shall mean the recognized name of the entities in the following list.  Names,
telephone numbers, and Web sites are subject to change and are believed to be accurate and up-
to-date as of the date of the Contract Documents.

ICC  International Code Council  (888) 422-7233
www.iccsafe.org

UBC  Uniform Building Code  (See ICC)
(See ICC)

D.  Federal Government Agencies:  Where abbreviations and acronyms are used in Specifications
or other Contract Documents, they shall mean the recognized name of the entities in the
following list.  Names, telephone numbers, and Web sites are subject to change and are believed
to be accurate and up-to-date as of the date of the Contract Documents.

OSHA  Occupational Safety & Health Administration  (800) 321-6742

E.  Standards and Regulations:  Where abbreviations and acronyms are used in Specifications or
other Contract Documents, they shall mean the recognized name of the standards and
regulations in the following list.  Names, telephone numbers, and Web sites are subject to
change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

MIL  (See MILSPEC)

MIL-STD  (See MILSPEC)

MILSPEC  Military Specification and Standards
Available from Department of Defense Single
Stock Point  (215) 697-2664
1.5 REFERENCES

A. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific documents version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
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<tbody>
<tr>
<td>ABMA 9</td>
<td>Load Ratings and Fatigue Life for Ball Bearings</td>
</tr>
<tr>
<td>ABMA 11</td>
<td>Load Ratings and Fatigue Life for Roller Bearings</td>
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<tr>
<td>AISC</td>
<td>American Institute of Steel Construction Manual of Practice</td>
</tr>
<tr>
<td>ANSI B1.1</td>
<td>Unified Screw Threads</td>
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<td>ANSI B1.20.1</td>
<td>Pipe Threads, General Purpose (Inch)</td>
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<tr>
<td>ANSI B16.1</td>
<td>Cast Iron Pipe Flanges and Flanged Fittings, Class 250</td>
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<td>ANSI B18.2.1</td>
<td>Square and Hex Bolts and Screws</td>
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<td>ANSI B18.2.2</td>
<td>Square and Hex Nuts</td>
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<td>ANSI/HI 1.1 – 1.6</td>
<td>Centrifugal Pumps</td>
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<tr>
<td>ANSI/HI 2.1 – 2.6</td>
<td>Vertical Pumps</td>
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<td>ANSI/HI 9.1 – 9.5</td>
<td>Pumps – General Guidelines</td>
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<td>ANSI/HI 9.6.1</td>
<td>Centrifugal and Vertical Pumps for NPSH Margin</td>
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<td>ANSI/HI 9.6.2</td>
<td>Centrifugal and Vertical Pumps for Allowable Nozzle Loads</td>
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<td>ANSI/HI 9.6.3</td>
<td>Centrifugal and Vertical Pumps Allowable Operating Region</td>
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<td>ANSI/HI 9.6.4</td>
<td>Centrifugal and Vertical Pumps. Vibration Measurements and Allowable Values</td>
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<td>ANSI/HI 9.8</td>
<td>Pump Intake Design</td>
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### Reference List

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<tr>
<td>API 610, 2003</td>
<td>Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industry</td>
</tr>
<tr>
<td>ASME Code</td>
<td>ASME Boiler and Pressure Vessel Code</td>
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<tr>
<td>ASTM A27</td>
<td>Steel Castings, Carbon, for General Application</td>
</tr>
<tr>
<td>ASTM A36</td>
<td>Carbon Structural Steel</td>
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<td>ASTM A148</td>
<td>Steel Castings, High Strength, for Structural Purposes</td>
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<td>ASTM A322</td>
<td>Steel Bars, Alloy, Standard Grades</td>
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<tr>
<td>ASTM A564</td>
<td>Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes</td>
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<tr>
<td>ASTM A571</td>
<td>Austenitic Ductile Iron Castings for Pressure- Containing Parts Suitable for Low-Temperature Service</td>
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<tr>
<td>AWWA C550</td>
<td>Protective Epoxy Coatings for Valves and Hydrants</td>
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<td>ISO 9001</td>
<td>Quality Systems</td>
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<td>MIL –PRF-907E</td>
<td>Anti-Seize Thread Compound, High Temperature</td>
</tr>
<tr>
<td>MIL STD 167-2</td>
<td>Mechanical Vibrations of Shipboard Equipment (Reciprocating Machinery and Propulsion System and Shafting)</td>
</tr>
<tr>
<td>Vibration Institute</td>
<td>Vibration Specialist Certification Requirements</td>
</tr>
<tr>
<td>Corbo and Malanoski, 1996</td>
<td>Practical Design Against Torsional Vibration, 25th Turbomachinery Symposium, Turbomachinery Laboratory, Texas A &amp; M University, p. 186 - 222</td>
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</table>
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01420
SECTION 01600 – DELIVERY, STORAGE, AND HANDLING

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. This Section specifies the general requirements for the delivery, handling, storage, and protection for all items required in the construction of the work. Specific requirements, if any, are specified with the related item. Contractor shall be responsible for the safe storage of equipment and materials.

1.2 TRANSPORTATION AND DELIVERY

A. The Contractor and his Suppliers are directed to contact the North Carolina Department of Transportation to verify axle load limits on State maintained roads (and bridges) which are to be used for hauling equipment and materials for this project. The Contractor and his Suppliers shall do all that is necessary to satisfy the Department of Transportation requirements and will be responsible for any damage to roads which may be attributed to this project.

B. All materials required to construct this project shall be furnished by the contractor and shall be delivered and distributed at the site by the Contractor or his material supplier.

C. Transport and handle items in accordance with manufacturer’s instructions.

D. Schedule delivery to reduce long term onsite storage prior to installation or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer.

E. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged, or sensitive to deterioration.

F. Deliver products to the site in manufacturer’s original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, and installing.

G. All items delivered to the site shall be unloaded and placed in a manner which will not hamper the Contractor’s normal construction operation or those of subcontractors and other contractors, and will not interfere with the flow of necessary traffic.

H. Provide necessary equipment and personnel to unload all items delivered to the site.

I. Promptly inspect shipment to assure that products comply with requirements, quantities are correct, and items are undamaged. For items furnished by others (i.e., Owner, other Contractors), perform inspection in the presence of the Engineer. Notify Engineer verbally and in writing of any problems.

1.3 STORAGE AND PROTECTION
A. Store and protect products in accordance with the manufacturer’s instructions, with seals and labels intact and legible. Storage instruction shall be studied by the Contractor and reviewed with the Engineer. Instruction shall be carefully followed and a written record of this kept by the Contractor. Arrange storage to permit access for inspection.

B. Store loose granular materials on solid flat surfaces in a well drained area. Prevent mixing with foreign matter.

C. Cement and lime shall be stored under a roof and off the ground, and shall be kept completely dry at all times. All structural, miscellaneous, and reinforcing steel shall be stored off the ground or otherwise to prevent accumulations of dirt or grease; and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping, or cracking. Brick, block, and similar masonry products shall be handled and stored in a manner to reduce breakage, cracking, and spalling to a minimum.

D. All Mechanical and electrical equipment subject to corrosive damage by the atmosphere if stored outdoors (even though covered by canvas), shall be stored in a weather-tight building to prevent damage. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the Engineer. Building shall be equipped with adequate ventilation to prevent condensation. Temperature and humidity must be maintained in the range recommended by the manufacturer.

1.4 PAYMENT FOR STORED MATERIALS

A. No payment shall be made by Owner to Contractor for any equipment or materials which are improperly stored.
SECTION 01630 – MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. This section covers methods of measurement and payment for items of Work under this Contract.

B. The total Bid Price shall cover all Work required by the Contract Documents. All costs in connection with the proper and successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction equipment and tools; and performing all necessary labor and supervision to fully complete the Work, shall be included in the lump sum prices bid. All Work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of Contractor, and all costs in connection therewith shall be included in the prices bid.

1.2 DEFINITIONS

A. Lump sum is an amount proposed by bidders, stated on the Bid Form, as a price to include all materials, labor, etc. for work furnished and installed, complete and operational.

1.3 PERMITS AND TAXES

A. Refer to GC-6.08 for payment of construction and license permits. The Contractor shall include costs of all construction permits and licenses in the bid.

B. Refer to GC-6.10 for payment of taxes. The Contractor shall include costs of state and local sales taxes in the Bid.

1.4 RETAINAGE

A. Refer to the Agreement.

1.5 EXCAVATION AND TRENCHING

A. Except where otherwise specified, the lump sum price bid for each item of Work which involves excavation or trenching shall include all costs for such Work. No direct payment shall be made for excavation or trenching. There shall be no separate payment for excavation and stabilization below grade, or special backfill for such excavation, unless specifically stated in the Measurement and Payment sections.

B. Except where otherwise specified, the lump sum price bid for each item of Work which involves excavation or trenching shall include all costs for rock excavation. There shall be no separate payment for Rock Excavation associated with the Project.
C. All excavation work required for structures, not otherwise paid for as trenching, shall be considered to be a subsidiary obligation of Contractor; and the cost of such excavation shall be included in the prices bid for the structures.

1.6 MEASUREMENT AND PAYMENT

A. Mobilization (Bid Item 1)

1. This bid item is for the cost incurred prior to beginning work on this contract, including permits, licenses, fees, insurance, bonds, equipment mobilization, signage, etc.

2. Payment for Mobilization shall be made on the basis of the Lump Sum Price Bid.

3. Payment for Mobilization shall be as follows:
   a) For any amount up to 5% of the subtotal (bid items 2-8 below) prior to the contingency allowance, one half of the amount bid will be paid with the first pay application.
   b) The remainder will be paid with the second pay application.
   c) If any amount greater than 5% of the subtotal is entered for mobilization, the difference in the amount entered and 5% will be paid on the final payment.

B. Furnish and Install New Horizontal Split Case Pumps (Bid Item 2)

1. Furnishing and installing horizontal split case pumps and motors as specified in the contract documents.

2. Payment for Furnish and Install New Horizontal Split Case Pumps shall be made on the basis of the Unit Cost Bid.

3. The Unit Bid Price shall include, but not be limited to:
   a) All materials, equipment, and labor required for the furnishing and installing of two (2) new 40 HP horizontal split case pumps and motors in place of existing 15 HP pumps and motors, bolting/mounting pump bases, pump air valve and associated vent piping, adjusting existing foundation/pedestals as required to meet field conditions, establishing pump power from new variable frequency drives, factory testing.
   b) Onsite testing and acceptance.
   c) Any items not included as part of other bid items but required for a complete and functional horizontal split case pump and motor installation.
4. Measurement for payment shall be for each horizontal split case pump and motor, complete in place. The quantity measured for partial payment shall be the percentage of the actual work completed as agreed upon by the owner and engineer.

5. Method of payment shall be the unit price amount stated in the bid.

C. Furnish and Install Suction and Discharge Piping Improvements (Bid Item 3)

1. Bid item includes furnishing and installing the suction and discharge piping improvements including all items from the pump suctions and discharges to the flanges above the floor as specified in the Contract Documents.

2. Payment for Furnish and Install Suction and Discharge Piping Improvements shall be made on the basis of the Lump Sum Price Bid.

3. The Lump Sum Bid Price shall include, but not be limited to:
   a) All materials, labor and equipment required for the furnishing and installing of all elements of suction and discharge piping improvements including ductile iron piping, fittings, flange gaskets and bolts, and pipe coatings. Bid item also includes closure of valves downstairs to isolate piping, and any draining of piping required prior to work.
   
   b) Testing and Acceptance.
   
   c) Any items not included as part of other bid items but required for a complete and functional suction and discharge piping assembly inside the pump building.

4. Measurement for payment shall be for one (1) suction and discharge piping and improvements, complete in place. The quantity measured for partial payment shall be the percentage of the actual work completed as agreed upon by the owner and engineer.

5. Method of payment shall be the Lump Sum amount stated in the bid.

D. Furnish and Install New Motor Control Center and Primary Power (Bid Item 4)

1. Bid item shall include furnishing and installing a new motor control center and providing primary power from the existing transformer on site as specified in the contract documents.

2. Payment for furnish and install New Motor Control Center and Primary Power shall be made on the basis of the lump sum bid.

3. The Lump Sum Price Bid shall include:
a) All materials, labor and equipment required for the furnishing and installing a new motor control center complete with panels, foundation assembly, and connections.

b) All materials, labor and equipment required for the furnishing and installing of primary power feed between new transformer (installed by others) and new MCC.

c) All materials, labor and equipment required for the finishing and installing of a new concrete pad for new transformer.

d) Testing and Acceptance.

e) Any items not included as part of other bid items but required for a complete and functional MCC and primary power supply.

4. Measurement for payment shall be for one (1) motor control center and primary power feed, complete and in place. The quantity measured for partial payment shall be the percentage of the actual work completed as agreed upon by the owner and engineer.

5. Method of payment shall be the Lump Sum amount stated in the bid.

E. Install New Variable Frequency Drives (Bid Item 5)

1. Bid item shall include the installation of two (2) new variable frequency drives (VFD) for operation of the two (2) new horizontal split case pump motors as specified in the contract documents. VFD units (with enclosures), complete with overload protection, ethernet/IP module, control power transformer, auxiliary relays, space heater, over-temperature trip, and protection plus warranty, shall be procured and supplied by others. Bid item shall include mounting of new VFD’s, including hardware and stands for VFD units as specified in the contract documents, furnishing and installing power wiring to include all terminations, furnishing and installing control and signal wiring without terminations at VFD and RTU.

2. Payment for furnish and install new variable frequency drives be made on the basis of unit price bid.

3. The Unit Price Bid shall include:

   a) All materials, labor and equipment required for installing new variable frequency drives at the locations specified on the drawings and all associated connectivity mentioned above.

   b) Testing and Acceptance.

   c) Any items not included as part of other bid items but required for a complete and functional variable frequency drive installation.
4. Measurement for payment shall be for each variable frequency drive mounted and installed complete and in place. The quantity measured for partial payment shall be the percentage of the actual work completed as agreed upon by the owner and engineer.

5. Method of payment shall be the unit price amount stated in the bid.

F. Furnish and Install New Portable Generator Connection (Bid Item 6)

1. Bid item shall include furnishing and installing a new portable generator connection on the exterior of the building along with associated manual transfer switch, as specified in the contract documents.

2. Payment for furnish and install new variable frequency drives be made on the basis of lump sum bid.

3. The lump sum bid price shall include:
   a) All materials, labor and equipment required for the furnishing and installing a new portable generator connection on the exterior of the building, along with associated manual transfer switch. Price shall include mounting of connection assembly to exterior wall using suitable hardware along with all required connectivity.
   b) Testing and Acceptance.
   c) Any items not included as part of other bid items but required for a complete and functional installation of equipment.

4. Measurement for payment shall be one (1) portable generator connection and manual transfer switch furnished and installed complete and in place. The quantity measured for partial payment shall be the percentage of the actual work completed as agreed upon by the owner and engineer.

5. Method of payment shall be the lump sum amount stated in the bid.

G. Demolition / Demobilization (Bid Item 7)

1. Bid item shall include the demolition of the existing motor control center and communications/instrumentation panel, along with cost incurred prior to Substantial Completion of the work including removal of equipment and materials, all painting of exposed surfaces as specified by the Contract Documents, and all interior and exterior cleaning as specified by the Contract Documents.

2. Payment for Demolition / Demobilization shall be based on the Lump Sum Price Bid.

3. The Lump Sum Price Bid shall include:
a) Demolition, removal, and disposal of existing motor control center and communications/instrumentation panel and restoration of surfaces to match surrounding surface conditions.

b) Removal of all Contractor owned equipment, temporary protection, and temporary facilities from the site.

c) Storage and disposal of all excess and/or removed materials as specified in the Contract Documents.

d) Painting of all interior and exterior surfaces including but not limited to equipment, piping, walls, conduit, and ductwork, as specified, complete in place.

e) Cleaning of all interior and exterior surfaces as specified in the Contract Documents.

4. Measurement for payment shall be for one (1) Lump Sum of all Demolition / Demobilization as specified.

5. Method of payment shall be the lump sum amount stated in the bid.

END OF SECTION 01630
SECTION 01700 – CONTRACT CLOSEOUT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary General Conditions, and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:

1. Inspection procedures.
2. Project record document submittal.
4. Submittal of warranties.
5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Approximately 28 days before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.

1. A written notice shall be submitted to the Engineer indicating that the Work, or a designated portion thereof, is substantially complete. The written notice shall include a list of items to be completed or corrected.

2. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.

   a) Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.

   b) If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

3. Advise the Owner of pending insurance changeover requirements.
4. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.

5. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

6. Submit record drawings, maintenance manuals, damage or settlement claims, and similar final record information.

7. Deliver tools, spare parts, extra stock, and similar items.

8. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.

9. Complete startup testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.

10. Complete final cleanup requirements, including touchup painting.

11. Touch up and otherwise repair and restore marred, exposed finishes.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.

2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

3. Submit a certified copy of the Engineer's final inspection list of items to be completed or corrected. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.

5. Submit a final liquidated damages settlement statement.

6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

7. Submit consent of surety to final payment.
8. Submit contractor’s and subcontractor’s Affidavit of Release of Liens

9. Submit contractor’s Affidavit of Payment of Debts and Claims

10. Submit Release of Liens from material and equipment suppliers.

B. Reinspection Procedure: The Engineer will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Engineer.

1. Upon completion of reinspection, the Engineer will prepare a certificate of final acceptance. If the Work is incomplete, the Engineer will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

1.5 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Engineer's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.

2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.

3. Note related change-order numbers where applicable.

4. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

C. Maintenance Manuals: Equipment manufacturers shall furnish 6 copies of an operating and maintenance manual covering their equipment. Manuals shall be submitted within 60 days of final shop drawing approval. Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch (51-mm), 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
1. Emergency instructions.
2. Spare parts list.
4. Wiring diagrams.
5. Recommended "turn-around" cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.
8. Fixture lamping schedule.
9. Manufacturer’s Name, Address and Phone Number.
10. Supplier’s Name, Address and Phone Number.

PART 2 – PRODUCTS

NOT APPLICABLE

PART 3 – EXECUTION

3.1 CLOSEOUT PROCEDURES

A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:

1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.
6. Fuels.
7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.

11. Warranties and bonds.

12. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Startup.

2. Shutdown.

3. Emergency operations.


5. Safety procedures.


7. Effective energy utilization.

3.2 FINAL CLEANING

A. General: The General Conditions require general cleaning during construction.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Clean-up operations shall consistently be carried on by the Contractor at all time to keep the premises free from accumulation of waste materials and rubbish. Upon completion of the work, he shall remove all rubbish, tools, scaffolding, surplus materials, etc., from the site; and shall leave his work in a condition satisfactory to the Engineer.

2. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.

   a) Remove labels that are not permanent labels.

   b) Remove all surplus and discarded materials, excavated material and rubbish from the roadways, sidewalks, parking areas, lawns and all adjacent property; restore, in an acceptable manner, all property, both public and private, which has been disturbed or damaged during the prosecution of the work; and shall leave the whole site in a neat and presentable condition.

   c) Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are
noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

d) Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

e) Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

f) Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.

C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.

1. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the Owner.

2. In case of dispute, the Owner may remove the rubbish and charge the cost to the several contractors as the Engineer shall determine to be just.
SECTION 01740 – WARRANTIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers’ standard warranties on products and special warranties.

Refer to the General Conditions for terms of the Contractor's period for correction of the Work.

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

1. Division 1 Section 01700 – Contract Closeout specifies contract closeout procedures.

2. Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.

3. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

C. Separate Prime Contracts: Each prime contractor is responsible for warranties related to its own contract.

1.3 DEFINITIONS

A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement.
The reinstated warranty shall be equal to the original warranty and time shall be extended by the amount of time lapsed between notification by the owner of a defect and acceptable repair or replacement by Contractor.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

F. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

G. Disclaimers and Limitations: Manufacturers disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.5 SUBMITTALS

A. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.

1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within 15 days of completion of that designated portion of the Work.

B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Engineer, for approval prior to final execution.

C. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

D. Form of Submittal: At Final Completion compile 3 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or
manufacturer.

E. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.

F. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.

G. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.

H. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 – PRODUCTS

NOT APPLICABLE

PART 3 – EXECUTION

NOT APPLICABLE

END OF SECTION 01740
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SECTION 01781 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Submit marked-up Progress Record Drawings.
B. Related Sections:
   1. Section 01700 "Contract Closeout" for general closeout procedures.
   2. Section 01782 "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. Divisions 2 through 16 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS
A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit one set of Record Drawings which illustrate the clouded plan revisions cross referenced to change orders and/or RFI implemented design revisions.
B. RFI Catalog: Comply with the following:
   1. Catalog project RFI’s in binder in chronological form.
   2. Provide RFI TOC and reference RFI subject.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS
A. Progress Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE
A. Recording:
1. Label each document “PROJECT RECORD” in neat, large, printed letters.

2. Record information concurrently with construction progress.
   a. Do not conceal any work until required information is recorded.

3. Drawings; legibly mark to record actual construction.
   a. Elevations of various elements of foundation in relation to finish datum.
   b. All underground piping with elevations and dimensions, specifically including fittings and valves and changes to piping location shall be referenced. Horizontal and vertical locations of underground utilities and appurtenances shall be referenced to permanent surface improvements. Markings shall include actual installed pipe material, class, etc.
   c. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structures.
   d. Field changes of dimension and detail.
   e. Changes made by Field Order or by Change Order.
   f. Details not on original Contract drawings.
   g. Equipment and piping relocations.

4. Specifications and Addenda; legibly mark each Section to record:
   a. Manufacturer, trade name, catalog number, and Supplier of each Product and item of equipment actually installed.
   b. Changes made by Field Order or by Change Order.

5. Shop Drawings (after final review and approval):
   a. One set of record shop drawings for each process equipment, piping, (including casings) electrical system and instrumentation system.

B. Maintain at the site for the Owner one (1) record copy of:

   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other Modifications to the Contract.
   5. Engineer’s Field Orders or Written Instructions.
   6. Approved Shop Drawings, Working Drawings, and Samples.
7. Field Test Records.
8. Construction Photographs.
9. Detailed Progress Schedule.

C. Maintenance of Record Documents and Samples:
   1. Store documents and samples in Contractor’s field office apart from other documents used for construction.
      a. Provide files and racks for storage of documents.
      b. Provide locked cabinet or secure storage space for storage of samples.
   2. File documents and samples in accordance with CSI/CSC format.
   3. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
   4. Make documents and samples available at all times for inspection by the Engineer.
   5. As a prerequisite for monthly progress payments, the Contractor is to exhibit the currently updated “record documents” for review by the Engineer and the Owner.

D. Review: RPR to review record drawings each month prior to approving pay application request.

END OF SECTION 01781
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SECTION 01782 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation manuals for systems, subsystems, and equipment.
   2. Product maintenance manuals.
   3. Systems and equipment maintenance manuals.

B. Related Sections:
   1. Section 01330 "Submittal Procedures"
   2. Divisions 2 through 16 Sections for specific operation and maintenance manual requirements.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.

B. Format: Submit operations and maintenance manuals in PDF Electronic Format and three paper copies.

C. Initial Manual Submittal: Submit draft copy of each O&M manual with the initial equipment submittal.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training.
PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project and Owner.
3. Date of submittal.
4. Name and contact information for Contractor.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

   1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf, post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

      a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.

      b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

   3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.


   5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

      a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams – showing complete terminal to terminal wiring routing.
7. Control diagrams – showing complete controls logic and sequencing
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.3 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions with complete disassembly, repair, and reassembly instructions and illustrations.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product,
list name, address, and telephone number of Installer or supplier and maintenance service agent,
and cross-reference Specification Section number and title in Project Manual and drawing or
schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation
including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly
   and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential
maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of
required lubricants for equipment, and separate schedules for preventive and routine
maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly,
   quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording
   maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with
parts identified and cross-referenced to manufacturers' maintenance documentation and local
sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and
telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and
conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.
PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Division 1 Section "Project Record Documents."

F. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01782
SECTION 02065 – DEMOLITION AND REMOVAL

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required for demolition, removal, and disposal of pipe, structures, equipment, and appurtenances shown or necessary to be removed for construction of the new work.

B. These specifications call attention to certain activities necessary to maintain and facilitate operation during and following construction, but do not purport to cover all of the activities necessary. The Contractor shall exercise due concern for utility system operation, and shall diligently direct all his activities toward maintaining continuous operation of existing facilities and minimizing operation inconvenience.

C. The work includes:

1. Complete removal where shown or necessary of existing pipe and structures and miscellaneous items, as shown on the Drawings, which are encountered in the way of the new work.

2. Partial removal where shown or necessary of existing pipe and structures which are encountered in the way of the new work.

3. Modification of structures, equipment, appurtenances, and utilities as necessary for continued operation during construction.

4. Removal and offsite disposal of demolished materials.

5. Backfill of removed below-grade structures and piping with imported common fill and topsoiling, preparation, and seeding (or sodding where specified) the areas disturbed by the work.

1.2 CONDITION OF STRUCTURES

A. The Owner and the Engineer assume no responsibility for the actual condition of the structures, pipes, or utilities to be removed or modified.

B. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. However, variations may occur prior to the start of demolition work.

1.3 RULES AND REGULATIONS

A. The Building Code of the State of North Carolina shall control the demolition, modification, or alteration of the existing buildings or structures.
B. No building or structure, or any part thereof, shall be demolished until an application has been filed by the Contractor with the Building Inspector and a permit issued. The fee for this permit shall be the Contractor’s responsibility.

C. No blasting shall be done onsite unless specifically authorized in writing by the Owner/Engineer. The Contractor shall not store any explosives onsite.

1.4 DISPOSAL OF MATERIAL

A. All demolished and removed material shall become the property of the Contractor.

B. All removed material shall be hauled to suitable waste disposal sites by the Contractor.

C. The storage or disposal of removed items on the site will not be allowed.

D. All disposal costs shall be included in the Bid prices.

E. Usable equipment removed from the site shall be provided to Owner. Contractor shall be responsible for delivering material to a local locale of the Owner’s choosing.

1.5 SUBMITTALS

A. Submit to the Engineer for approval two (2) copies of proposed methods and operations of demolition and removal of structures and modifications seven days prior to performance of the work. Include the coordination of shut-off, capping, and continuation of utility services as required.

B. Provide a detailed sequence of the demolition and removal work. Indicate where removed materials will be disposed of.

C. Actual work will not begin until the Engineer has inspected and approved the proposed scope and authorized commencement of the demolition work.

D. The above procedures must be followed for each individual removal operation.

1.6 TRAFFIC AND ACCESS

A. Conduct demolition, removal, and modification operations to ensure minimum interference with roads and other facilities and utilities.

B. Special attention is directed towards maintaining safe and convenient access to the existing facilities by operating personnel and associated vehicles.

1.7 PROTECTION

A. Conduct operations to preclude damage to adjacent buildings, structures, utilities, roadways, storm drainage, and other facilities. Provide interior and exterior shoring, bracing, or support to prevent movement or settlement or collapse of structures to be demolished, and adjacent facilities to remain.
1.8 DAMAGE
A. Promptly repair damage caused to adjacent facilities by demolition operations as directed by the Engineer and at no additional cost to the Owner.

1.9 UTILITIES
A. Maintain existing utilities and protect against damage during demolition operations.
B. Where maintenance is not practicable, provide temporary services during interruptions to existing utilities acceptable to the Engineer.
C. The Contractor shall cooperate with the Owner regarding utilities serving existing facilities affected by demolition operations.
D. The Contractor shall make all necessary arrangements and perform any necessary work involved in connection with the discontinuance or interruption of public and private utilities.
E. All utilities being abandoned shall be terminated as required by the utility companies or other owner.
F. All existing storm sewer pipes, catch basins (inlets), manholes, swales, ditches, and appurtenances shall remain in operation during construction to prevent flooding.

1.10 POLLUTION CONTROL
A. Use water sprinkling, temporary enclosures, and other suitable methods as necessary to limit the amount of dust to the lowest level practical for the conditions of the work. Comply with the governing regulations.
B. Clean adjacent structures and improvements of all dust, dirt, and debris caused by demolition operations as directed by the Engineer. Return areas to conditions existing prior to the start of work.

PART 2 – PRODUCTS.
(NOT USED)

PART 3 – EXECUTION

3.1 SEQUENCE OF WORK
A. The sequence of demolition and removal of existing aerial sanitary sewers will be in accordance with the approved schedule for performance of the new work.

3.2 REMOVAL OF EXISTING STRUCTURES, EQUIPMENT, AND PIPING
A. Subject to the constraints of maintaining the existing utilities in operation, existing structures, equipment, piping, stormwater facilities, and appurtenances shall be removed
as shown, as necessary for construction of the new facilities, and as directed by the Engineer.

B. All discontinued piping shall be capped or plugged as shown on the Drawings or as otherwise directed by the Engineer.

C. Utilities temporarily removed or relocated shall be reinstalled with equal or better materials as approved by the Engineer.

3.3 BURIED PIPING

A. Remove all abandoned buried piping encountered during excavation unless otherwise directed by the Engineer. Pipes not removed shall have open ends plugged with concrete. The Engineer shall determine the location of where the pipes are to be plugged.

3.4 HAULING

A. Hauling of removed materials for disposal shall be performed in a manner meeting all applicable requirements. No mud, soil, or debris shall be deposited on paved roads. Trucks shall be kept clean and all loads covered to preclude loss during transport.

B. Hazardous or controlled materials shall be transported, handled, and disposed of in a manner meeting all applicable regulations. Proof of proper disposal shall be provided to the Engineer.

3.5 BACKFILL

A. After removal of all buried pipes, manholes, and below-grade structures, the area shall be restored to the finish grade of the area with imported common fill meeting the requirements of Section 02220 for Class II or Class III materials. The fill shall be placed and compacted as follows:

1. Where new pipes, manholes, structures, trails, or roads are to be constructed in the backfilled area, place fill in maximum 9-inch level layers and compact to at least 95% of maximum dry density.

2. Where the backfilled area is to be seeded to grass, place fill in maximum 12-inch level layers and compact to at least 85% of maximum dry density.

3. Contractor shall fill and restore any areas that have settled below the finish grade of the area at the time of final inspection of the work.

3.6 RESTORATION

A. All areas where removals take place and all areas disturbed by the work shall be restored to better than original condition.

B. In paved areas, restoration shall be pavement as specified and shown on the Drawings.
C. In grassed or wooded areas, restoration shall comprise finish grading, preparation, liming, fertilizing, seeding and mulching, and creating a healthy cover of grass. Finish grading is specified in Section 02220. Topsoiling, seeding, mulching, and sodding are specified in Section 02230.

D. Any complaints of property owners shall be remedied promptly by the Contractor.

END OF SECTION 02065
SECTION 02190 – EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Take every reasonable precaution throughout construction to prevent the erosion of soil and the sedimentation of streams or other water impoundments, ground surfaces, or other property as required by State and Local regulations.

1.2 RELATED WORK

A. Provide protective covering for disturbed areas upon suspension or completion of land-disturbing activities. Permanent vegetation shall be established at the earliest practicable time. Temporary and permanent erosion control measures shall be coordinated to assure economical, effective, and continuous erosion and siltation control throughout the construction and post-construction period.

1.3 REGULATORY REQUIREMENTS

A. Prevent damage to properties outside the construction limits from siltation due to construction of the project. Assume all responsibilities to the affected property owners for correction of damages which may occur. Erosion control measures shall be performed conforming to the requirements of and in accordance with plans approved by applicable state and local agencies and as per the erosion control portion of the construction drawings and these specifications. The Contractor shall not allow mud and debris to accumulate in the streets. Should the Contractor pump water from trenches during construction, appropriate siltation preventative measures shall be taken prior to discharge of pumped water into any storm drain or stream.

PART 2 – PRODUCTS

2.1 PRODUCTS

A. Open mesh biodegradable mulching cloth.

B. Fertilizer shall be 10-10-10 grade or equivalent.

C. Lime shall be Dolomitic Agricultural Ground limestone containing not less than 10% magnesium oxide.

D. Phosphate shall be 20% superphosphate or equivalent.

E. Provide permanent grass seed in accordance with Section 02230.

F. Provide temporary grass seed in accordance with Section 02230.

G. Silt fence shall consist of non-biodegradable filter fabric (Trevira, Mirafi, etc.) wired to galvanized wire mesh fencing and supported by metal posts.
H. Erosion Control Stone: NCDOT Section 1042

1. Class 1 Rip Rap 5 lbs. to 200 lbs.
2. Class 2 Rip Rap 25 lbs. to 250 lbs.
3. Class A 2” to 6”
4. Class B 5” to 15”

I. Filter Fabric for placement under rip rap shall meet the requirements of Type 2 fabric in accordance with NCDOT standards and specifications, Section 1056-2 for Roads and Structures.

PART 3 – EXECUTION

3.1 CLEARING

A. Clearing and grubbing shall be scheduled and performed in such a manner that subsequent grading operation and erosion control practices can follow immediately thereafter. Excavation, borrow, and embankment operations will be conducted as a continuous operation. All construction areas not otherwise protected shall be planted with permanent vegetative cover within 7 calendar days after completion of active construction for all slopes steeper than 3:1, high quality water zones, perimeter dikes, swales, and ditches; or 14 calendar days after completion of active construction for all other areas.

3.2 STABILIZING

A. The angle for graded slopes and fills shall be no greater than the angle which can be retained by vegetative cover or other adequate erosion control devices or structures. Ground stabilization must be provided on exposed slopes within 14 calendar days following completion of any phase of grading and/or at the completion of construction or development. Slopes steeper than 3:1, high quality water zones, and perimeter dikes, swales, and/or ditches shall be stabilized within 7 calendar days following completion of any phase of grading and/or at the completion of construction or development.

3.3 REGULATORY REQUIREMENTS

A. Whenever land disturbing activity is undertaken on a tract, a ground cover sufficient to restrain erosion must be planted or otherwise provided within 14 calendar days on that portion of the tract upon which further active construction is to be undertaken.

B. If any earthwork is to be suspended for any reason whatsoever for longer than 14 calendar days, the areas involved shall be seeded with vegetative cover or otherwise protected against excessive erosion during the suspension period. Suspension of work in any area of operation does not relieve the Contractor of the responsibility for the control of erosion in that area.
3.4 CONSTRUCTION PHASE PRACTICES

A. Avoid dumping soil or sediment into any stream bed or watercourse.

B. Maintain an undisturbed vegetative buffer where possible between a natural watercourse and trenching and grading operations.

C. Avoid equipment crossings of streams, creeks, and ditches where practicable.

3.5 SEDIMENT CONTROL FEATURES

A. General

1. All devices (silt fences, retention areas, etc.) for sediment control shall be constructed at the locations indicated prior to beginning excavation on the site. All devices shall be properly maintained in place until a structure or paving makes the device unnecessary or until directed to permanently remove the device.

B. Design Applications

1. Mulch shall be used for temporary stabilization of areas subject to excessive erosion, and for protection of seed beds after planting where required.

2. Silt fences shall be used as shown on the plans to restrict movement of sediment from the site. Silt fence shall be installed prior to when grading commences.

3. Establish vegetative cover on all unpaved areas disturbed by the work.

a. Preparation of Seedbed. Areas to be seeded shall be scarified a depth of six inches until a firm, well pulverized, uniform seedbed is prepared. Lime, phosphorous, and fertilizer shall be applied during the scarification process in accordance with the following rates:

1) Lime – 1 ton per acre.

2) Phosphorous – 500 pounds per acre.

3) Fertilizer – 500 pounds per acre.

b. Seeding. Disturbed areas along embankments shall be permanently seeded with mix specified in Section 02230. Seeding performed during the period from October to February shall be temporarily in accordance with Section 02230. The permanent vegetative cover will be over seeded at the earliest possible time as specified.

c. Mulch all areas immediately after seeding. Mulch shall be applied and anchored as specified hereinbefore.

3.6 MAINTENANCE
A. Maintain all temporary and permanent erosion control measure in functioning order. Temporary structures shall be maintained until completion of the project. Areas which fail to show a suitable stand of grass or which are damaged by erosion shall be immediately repaired.

3.7 REMOVAL OF SEDIMENT CONTROL DEVICES

A. Near completion of the project, when directed by the Owner’s agent, the Contractor shall dismantle and remove the temporary devices used for sediment control during construction. All erosion control devices in seeded areas shall be left in place until the grass is established. Seed areas around devices and mulch after removing or filling temporary control devices.

**TABLE 6.10a**

Temporary Seeding Recommendation for Late Winter and Early Spring

**Seeding Mixture**

*Species Rate (lb/acre)*

- Rye (grain) 120
- Annual lespedeza (Kobe in Piedmont and Coastal Plain; Korean in Mountains) 50

Omit annual lespedeza when duration of temporary cover is not to extent beyond June.

**Seeding Dates**

- Mountains:
  - Above 2500 ft: Feb 15 - May 15
  - Below 2500 ft: Feb 1 - May 1
- Piedmont: Jan 1 - May 1
- Coastal Plain: Dec 1 - April 15

**Soil Amendments**

Follow recommendations of soil tests or apply 2,000 lb/acre ground agricultural limestone and 750 lb/acre 10-10-10 fertilizer.

**Mulch**
Apply 4,000 lb/acre straw. Anchor straw by tacking with asphalt, netting, or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

Maintenance

Re-fertilize if growth is not fully adequate. Reseed, re-fertilize, and mulch immediately following erosion or other damage.
TABLE 6.10b
Temporary Seeding Recommendations for Summer

Seeding Mixture

Species Rate (lb/acre)

- German millet 40

In the Piedmont and Mountains, a small-stemmed Sudangrass may be substituted at a rate of 50 lb/acre.

Seeding Dates

- Mountains - May 15 - Aug 15
- Piedmont - May 1 - Aug 15
- Coastal Plain - April 15 - Aug 15

Soil Amendments

Follow recommendations of soil tests or apply 2,000 lb/acre ground agricultural limestone and 750 lb/acre 10-10-10 fertilizer.

Mulch

Apply 4,000 lb/acre straw. Anchor straw by tacking with asphalt, netting, or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

Maintenance

Re-fertilize if growth is not fully adequate. Reseed, re-fertilize and mulch immediately following erosion or other damage.
**TABLE 6.10c**

Temporary Seeding Recommendations for Fall

**Seeding Mixture**

<table>
<thead>
<tr>
<th>Species Rate (lb/acre)</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rye (grain)</td>
<td>120</td>
</tr>
</tbody>
</table>

**Seeding Dates**

- **Mountains** - Aug 15 - Dec 15
- **Coastal Plain and Piedmont** - Aug 15 - Dec 30

**Soil Amendments**

Follow recommendations of soil tests or apply 2,000 lb/acre ground agricultural limestone and 1000 lb/acre 10-10-10 fertilizer.

**Mulch**

Apply 4,000 lb/acre straw. Anchor straw by tacking with asphalt, netting, or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

**Maintenance**

Repair and re-fertilize damaged areas immediately. Topdress with 50 lb/acre of nitrogen in March. If it is necessary to extend temporary cover beyond June 15, over-seed with 50 lb/acre Kobe (Piedmont and Coastal Plain) or Korean (Mountains) lespedeza in late February or early March.

**END OF SECTION 02190**
SECTION 02220 – EXCAVATING, GRADING, TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 GENERAL

A. The contractor shall furnish all labor, equipment, supplies and materials, and perform all operation in connection with the excavations, grading and backfilling, including borrow for drainage structures, curb and gutter, sidewalks, driveways, pavements, slopes, storm drains, water and sanitary sewer lines, including all hauling, wetting, rolling and other operations pertaining thereto within the clearing limits, complete, in strict accordance with this section of the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

1.2 EXISTING CONDITIONS

A. The Contractor should become familiar with the site and satisfy himself as to the scope of the work involved and the materials to be encountered. Any significant change in conditions should be immediately brought to the attention of the Owner's representative.

1.3 REFERENCES

A. ASTM C33 – Standard specification for concrete aggregates
B. ASTM C136 – Sieve analysis of fine and coarse aggregates.

1.4 QUALITY ASSURANCE

A. The Contractor will engage a soil testing and inspection program for quality control testing during earthwork operations. Soil testing and inspection shall be performed by an independent laboratory employed by the Contractor, and all reports shall be submitted directly to the Engineer and Owner.

1.5 SUBMITTALS

A. Submit the following reports directly to the Engineer/Owner from the independent testing laboratory.
1. Test reports on borrow and fill material including optimum moisture-maximum density curve for each type of soil and from each borrow source.

2. Field density test reports.

3. Report of actual unconfined compressive strength and/or results of bearing test of each stratum tested.

B. Submit as-built record drawings denoting final grades and elevations. Report conflicts, errors and inconsistencies in grades and elevations to the Engineer for resolution. See Section 1700 Contract Closeout and Section 01781 Project Record Documents.

PART 2 – PRODUCTS

2.1 SOILS

A. General: Use soils free of organic matter, refuse, rocks and lumps greater than 4 inches in diameter and other deleterious matter.

B. Classification: For the purpose of this specification, soils to be used as fill material are grouped into five classes according to soil properties and characteristics.

Class I - Angular, 6 to 40-mm (1/4 to 1-1/2 in.), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, crushed gravel, and crushed shells.

Class II - Coarse sands and gravels with maximum particle size of 44 mm (1-1/2 in.), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class.

Class III - Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil Types GM, GC, SM, and SC are included in this class.

Class IV - Silt, silty clays, and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil Types MH, ML, CH, and CL are included in this class. These materials are not recommended for bedding, haunching, or initial backfill, or fill under slabs.

Class V - This class includes the organic soil, OL, OH, PT as well as soils containing frozen earth, debris, rocks, larger than 40 mm (1-1/2 in.) in diameter, and other foreign materials. These materials are not recommended for bedding, haunching, or initial backfill, or fill under slabs.

C. Topsoil: Natural, friable soil free of subsoil, stumps, rocks larger than 2 inches in diameter, weeds and other material detrimental to plant growth.

D. Granular Fill: Granular fill under slabs shall be Class I material.

E. Structural Fill: Fill material placed inside the line of the building foundation or slab shall be Class I or II.
F. Fill Beneath Pavement: Fill material used beneath pavement and for road shoulders shall be Class II or III.

G. General Fill: General fill material not otherwise specified shall be Class II or III.

H. Trench Backfill: Material used for bedding, haunching and initial backfill shall be as specified hereinafter.

2.2 CRUSHED STONE

A. Crushed stone shall be size no. 57, with fines present to stabilize it. If fines are insufficient, stone screenings shall be added to extent required to stabilize it.

PART 3 – EXECUTION

3.1 GENERAL

A. Familiarization: Prior to commencement of the earthwork, become thoroughly familiar with the site, the site conditions, and all portions of the work specified in this Section.

B. Approvals: Backfilling and grading operations near slabs, foundations, walls, pipes and other portions of the work to be covered shall not commence until the Owner's Representative has completed all required inspections, tests and approvals. Work covered prior to inspection shall be uncovered for inspection purposes and backfilled.

3.2 SURFACE PREPARATION

A. Clearing: Areas designated for clearing and required for construction operations shall be cleared of trees, brush, structures and other materials.

B. Grubbing: Roots, stumps and other materials shall be grubbed from the cleared areas to a depth of at least 18 inches.

C. Topsoil: Strip existing topsoil to a depth of 4 inches or to the depth encountered, whichever is greater, from areas to be excavated or graded. Stockpile the topsoil in a suitable area for use during final grading operations. Protect the topsoil from excessive erosion.

D. Unsuitable Material: Remove sod, muck or other unsuitable material to firm subsoil in areas designated for filling or grading operations.

E. Disposal: Trees, stumps, roots, rubbish, unsuitable soil or other material resulting from surface preparation shall be removed from the site by the Contractor and disposed of.

3.3 EXCESS WATER CONTROL

A. General: Grade and maintain all areas of the site to preclude surface runoff into excavations and prevent ponding of water.

B. Dewatering: Excavations should be kept free of surface water and/or groundwater. Provide and maintain at all times the necessary means and devices to prevent water from entering the excavations and for removing all water entering the excavations.
C. Softened Subgrade: Remove all soil softened or eroded by the presence of water and replace with suitable backfill material.

D. Proof Rolling:

1. Proof roll areas to receive fill, pavement and building slabs to identify areas of soft yielding soils.
   a) Use loaded tandem-axle pneumatic tired dump truck or large smooth drum roller.
   b) Load equipment to maximum 50 tons gross weight and make a minimum of four passes with two passes perpendicular to the others.

2. Undercut areas of soft yielding soils to firm soil, backfill with granular fill, and compact to density equal to or greater than requirements for subsequent fill material.

3. Do not proof roll or undercut until soil has been dewatered.

3.4 EXCAVATION

Excavation shall be accomplished in accordance with the grades and lines as established by the Engineer and as required by the work to be performed. Excavation shall include the removal and replacement of all asphalt, concrete, curb, rock, earth, fences, trees (as directed by the Engineer), shrubs, and other materials as applicable. The contractor will exercise care to prevent undercutting lower than the required subgrades. All materials from excavation, considered as suitable by the Engineer, shall be used as fill wherever required, and the Contractor shall arrange his work so that this usage of excavated materials will be possible. Unsuitable and surplus materials from excavation, if any, shall be disposed of by the Contractor at his expense. All areas of the site shall be graded and maintained at all times to prevent surface runoff from draining into the excavations, and to prevent ponding of water therein.

Excavated materials not required for topsoil, fill or backfill shall be removed from the site of the work by the Contractor, but none shall be deposited on private property without written consent of the property owner.

A. Unsuitable Materials: Unsuitable materials encountered in an excavation shall be removed as directed by the Owner's representative, backfilled with suitable material and compacted. Unsuitable materials include organic soils, muck, soft and compressible silts and clays and running sands.

B. Undercutting: Undercutting, unless authorized by the Engineer, shall be replaced and compacted, as specified in paragraph 3.6, at the Contractor's expense. If the material, after excavation to subgrade, is found to be soft, spongy or unfit for use as subgrade, such unsuitable material shall be removed to a depth as directed by the Engineer and the subgrade shall be brought to proper elevation by filling with suitable material from excavation or from an approved borrow site.
C. Borrow: The Contractor will supply all borrow necessary and will provide all labor and equipment necessary to dig and haul such borrow. The placing of borrow shall be as provided for in the paragraph 3.6.

3.5 PREPARATION OF SUBGRADE

A. General: Upon completion of site preparation and excavation, scarify to a depth of 8 inches and compact as specified. For areas to receive fill, the compacted subgrade shall be scarified to a depth of four inches prior to placing the fill.

3.6 FILL AND COMPACTION

A. When and where existing plans and grades require the use of fill to reach the required elevation, the Contractor shall deposit suitable material from borrow sites. Such material shall be free from debris, roots, trash, stones, or other harmful substances, and shall be spread in successive layers of loose material not more than 8 inches in depth. Each layer shall be spread uniformly by tractor type dozer, motor grader, or other approved device and rolled with an approved tamping or three-wheeled power roller until thoroughly compacted to 95 percent of maximum density obtained at optimum moisture content, as determined by ASTM D698 (Standard Proctor).

Fills shall be shaped and maintained at all times during their construction to prevent an accumulation of standing water in the event of rain.

B. Moisture Conditioning: Moisten or aerate the subgrade and fill material as required to obtain proper compaction.

C. Structural Fill: Compact the subgrade and fill to a minimum of 95 percent ASTM D698 (Standard Proctor) maximum density at optimum moisture content.

D. Granular Fill: Place granular fill on compacted, uncompacted fill or subgrade and compact to a minimum 100 percent ASTM D698, maximum density at optimum moisture content.

E. Pavement Areas: Compact the subgrade and fill material beneath paved areas and shoulders to a minimum 100 percent ASTM D698 maximum density at optimum moisture content.

F. Landscaped Areas: Compact the subgrade and fill to a minimum 95 percent ASTM D698 maximum density at optimum moisture content. Compact topsoil to 85 percent ASTM D698 maximum density at optimum moisture content.

3.7 FINISH GRADING

A. General: Perform finish grading to the lines and grades shown on the drawings. Finished grades should be smooth and uniform and provide positive drainage.

B. Tolerances

1. Rough Grade: Plus or minus 0.1 foot

2. Finish Grade under Slab or Paved Areas: Plus or minus 0.1 foot
C. Topsoil: The top 4 inches of soil in landscaped areas shall be topsoil.

D. Protection: Protect areas which have been graded from equipment traffic.

3.8 FOUNDATION PREPARATION

A. Prepare the subgrade by compacting existing grade and fill below the foundation to 95 percent Standard Proctor Test. Install a minimum 6-inch thick lift of #57 stone below all foundations. Prior to compaction and placing stone, in the event unusual soil conditions are uncovered, notify the Owner and Engineer prior to foundation construction for instructions how to proceed. Adjustment in the footing/slab depths and general foundation construction may be made by the Engineer before work proceeds. Contractor is responsible for performing any such adjustments.

B. Reference the structural Drawings for additional requirements.

3.9 TRENCHING, BACKFILLING AND COMPACTION FOR UTILITY SYSTEMS

A. General: Refer to specific utility sections in these specifications for installation requirements. Trench, backfill and compact as specified except as modified herein.

B. Trenching: Trench widths at and below the top of the pipe shall be the minimum necessary for proper installation. Trench banks above the top of the pipe shall be as vertical as practicable. Overdepth excavation shall be backfilled with Class I material and compacted. The Contractor shall provide, at his expense and as directed by the Owner's representative, special bedding material or concrete encasement as may be necessary due to over-width excavation.

C. Depth: Trench to the lines and grades shown on the drawings. Grade trenches to provide a constant slope free of sags and high spots.

D. Dewatering: Keep trenches free of water. Include cost of dewatering in unit price bid for pipe. No additional payment for this item is permitted.

E. Trench Bracing: Properly brace, sheet, and support trench walls as soil conditions indicate and in strict conformance with all pertinent laws and OSHA regulations. Provide adequate bracing and shoring to protect adjacent improvements.

F. Bedding, Haunching and Initial Backfill: Tamp to provide firm, even bedding. Excavate bedding material to match the shape of the bottom of the pipe and bell, as detailed in the drawings. Place haunching material so as to provide full bearing around the bottom of the pipe. Place bedding haunching and initial backfill as specified below.

G. Backfill: Backfill the remainder of the trench in accordance with paragraphs 2.1 and 3.6 of this section. Backfill from embedment zone to surface grade may be by hand of mechanical placement. Trench backfill shall be compacted in 8-inch lifts.

H. Foundation: Foundation shall be required in wet, yielding, and mucky locations. Foundation shall be constructed by removal of wet, yielding, or mucky material and its replacement with sufficient Class I material to correct the instability. In areas where foundation is required bedding shall be class I only.
3.10 FIELD QUALITY CONTROL

A. Field inspection, sampling and testing will be performed per owner's instructions.

B. Perform in-place compactions tests in accordance with the following:

C. Frequency of Tests:
   1. Finish Grade under Slab or Pavement Areas: Twice per lift for every 5,000 square feet.
   2. Landscape or Rough Grade Areas: Twice per lift for every 10,000 square feet.

D. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION 02220
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SECTION 02230 – SEEDING

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Seeding, hydro-seeding, mulching, and fertilizer.

1.2 RELATED SECTIONS

A. Section 02190 – Erosion and Sedimentation Control.
B. Section 02220 – Excavating, Grading, Trenching, and Backfilling.

1.3 REFERENCES

A. FS O-F-241 – Fertilizers, Mixed, Commercial.

1.4 DEFINITIONS


1.5 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.6 REGULATORY REQUIREMENTS

A. Comply with all regulatory agencies for fertilizer and herbicide composition.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site and to prevent damage from wetness and weather conditions.
B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of Manufacturer.

PART 2 – PRODUCTS

2.1 SEED SUPPLIERS

A. Suppliers which meet seed mixture requirements.
2.2  SEED MIXTURE

A. Temporary Seeding:

1. October to February
   Rye Grain – 180 pounds/acre
   Crimson Clover - 20 pounds/acre

2. July to September
   Brown Top Millet – 40 pounds/acre
   German (Foxtail) Millet - 40 pounds/acre

B. Permanent Seeding – March to October

1. Landscaped areas – match existing
   a. Bermudagrass, common, apply at 40 pounds per acre.
   b. Rebel or other turf type tall fescue, apply at 150 pounds per acre.

2.3  SOIL MATERIALS

A. Topsoil: As specified in Section 02220.

2.4  ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Fertilizer: FS O-F-241, Type 1, Grade A; recommended for grass, with 50% of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil to the following proportions: Nitrogen 10%, phosphoric acid 10%, soluble potash 10%.

C. Lime shall comply with the rules and regulations of the NC Department of Agriculture. It shall be agricultural grade ground dolomitic limestone containing not less than 85% of combined calcium and magnesium carbonates. It shall be so graded that 100% will pass a No. 10 sieve, and 40% will pass a No. 100 sieve. During handling and storage, lime shall be protected against hardening and caking. Any hardened or caked lime shall be pulverized to its original condition before being used.

D. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

E. Erosion Fabric: Jute, mesh, etc.
PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this Section.

3.2 FERTILIZING

A. Apply fertilizer at a rate of 1,000 pounds per acre.
B. Apply lime at a rate of three tons per acre.
C. Apply after smooth raking of topsoil and prior to roller compaction.
D. Do not apply fertilizer or lime at same time or with same machine as will be used to apply seed.
E. Mix thoroughly into upper two inches of topsoil.
F. Lightly water to aid the dissipation of fertilizer.

3.3 SEEDING

A. Apply seed at the rate designated on schedule evenly in two intersecting directions. Rake in lightly.
B. Do not seed areas in excess of that which can be mulched on the same day.
C. Do not sow immediately following rain, when ground is too dry, or during windy periods.
D. Roll seeded area with roller not exceeding 112 pounds.
E. Immediately following seeding and compacting, apply mulch to a thickness of 1/8-inch. Maintain clear of shrubs and trees.
F. Apply water with a fine spray immediately after each area has been mulched. Saturate to four inches of soil.

3.4 HYDRO-SEEDING

A. Apply seeded slurry with a hydraulic seeder at the rate designated on schedule evenly in two intersecting directions.
B. Do not hydro-seed area in excess of that which can be mulched on the same day.
C. Immediately following seeding, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.
D. Apply water with a fine spray immediately after each area has been mulched. Saturate to four inches of soil.

3.5 SEED PROTECTION

A. Upon completion of seeding, apply straw mulch at a rate of 4,000 pounds per acre. Tack mulch by crimping with crimping attachment.

B. Cover seeded slopes where grade is six inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

C. Lay fabric smoothly on surface, bury top end of each section in six inch deep excavated topsoil trench. Provide 12-inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

D. Secure outside edges and overlaps at 36-inch intervals with stakes.

E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

F. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum six inches.

END OF SECTION 02230
SECTION 15060 - DUCTILE IRON PIPING AND FITTINGS

PART 1 - SCOPE

1.01 SCOPE

A. The work included in this section consist of furnishing all material, equipment, labor and performing all operations necessary for the supply of all piping, fittings and accessories within the limits of work, as shown on the drawings and specified herein.

B. Where references are made to other standards or codes, unless specific date references are indicated the latest edition of said standard or code shall govern.

1.02 PIPING LAYOUT

Field verify dimensions prior to preparation of layout and shop drawings. Obtain shop drawing approval from OWNER and ENGINEER prior to fabrication of piping. All items not specifically mentioned in the Specifications or noted on the approved Plans, but which are obviously necessary to make a complete working installation, shall be included.

1.03 DELIVERY, STORAGE AND HANDLING

A. During shipping, delivery and installation of pipe and accessories, handle in a manner as to ensure a sound undamaged condition.

B. Exercise particular care not to injure pipe coatings.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS: DUCTILE IRON AND CAST IRON

GENERAL

As used herein, "ANSI" denotes the American National Standards Institute, "AWWA" denotes the American Water Works Association, and "ASTM" denotes the American Society for Testing and Materials. All pipe and fittings to be furnished hereunder shall conform to the referenced ANSI and/or AWWA Standard as modified herein, as appearing in the following sections. All markings required on pipe and fittings, shall be clearly legible and located such that they will not be hidden or destroyed when assembled into the intended system.

B. PIPE

1. All pipe shall be ductile iron pipe conforming to ANSI/AWWA Standard C151/A21.51-02, Ductile-Iron Pipe, Centrifugally Cast, for Water". All pipe and fittings for water applications shall be in full compliance with ANSI/NSF 61, "Drinking Water System Components-Health Effects". Manufacturers shall maintain their NSF certification for the duration of the Contract and any extensions thereof.
2. The pipe thickness and outside diameter of pipe for water usage shall conform to Tables 1 and 2 (for push-on and mechanical joint pipe, respectively) of ANSI/AWWA Standard C151/A21.51-02 for the following sizes (The pressure class specified is the minimum permitted):

<table>
<thead>
<tr>
<th>Size</th>
<th>Pressure Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-inch through 12-inch</td>
<td>350</td>
</tr>
<tr>
<td>14-inch through 20-inch</td>
<td>250</td>
</tr>
<tr>
<td>24-inch</td>
<td>200</td>
</tr>
<tr>
<td>30-inch through 54-inch</td>
<td>150</td>
</tr>
</tbody>
</table>

3. For restrained joint pipe, the thickness of the pipe barrel remaining after grooves are cut, if required in the design of restrained end joints, shall not be less than the nominal wall thickness of equal sized non-restrained joint pipe as shown above.

4. Each piece of pipe shall be marked as required in Subsection 4.6 of AWWA C151-02. Letters and numerals on pipe sizes 12-inch and smaller shall be not less than 3/8-inch.

5. The single gasket push-on pipe shall be shipped in standard 18-foot or 20-foot lengths, but not both. The restrained single-gasket push-on joint pipe shall be shipped in standard 18 or 20-foot lengths as specified above or fabricated lengths as noted in each order. At least two lengths of each size of single gasket push-on pipe furnished under each order shall be tested with circumferential gauges to insure that the pipe may be cut at any point along its length and have an outside diameter which will be within the manufacturer's standard design dimensions and tolerances for plain pipe. These lengths shall be identified with an easily distinguished, painted marking, longitudinally along the full length of the pipe.

C. FITTINGS

1. Fittings Conforming with ANSI/AWWA C110/A21.11-98 (Water & Sewer Use)

Restrained push-on joint fittings shall be cast ductile iron for use with ductile-iron pipe as specified above. Standard mechanical joint, push-on joint and flanged joint fittings shall also be ductile iron for use with ductile-iron pipe as specified above. Cast ductile-iron fittings in the 3-inch through 24-inch size range shall be pressure rated at 350 psi, minimum; (except flange-joint fittings shall be rated at 250 psi, minimum); and in the 30-in to 48-in size range shall be pressure rated at 250 psi, minimum. All fittings with mechanical joints, flange joints and push-on joints shall conform to ANSI/AWWA Standard C110/A21.10-98, "Ductile-Iron and Gray-Iron Fittings, 3-in to 48-in for Water and Other Liquids". In addition, fittings with mechanical joints and push-on joints shall conform to ANSI/AWWA Standard C111/A21.11-00, "Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings".

2. Fittings Conforming with ANSI/AWWA C153/A21.53-00 (Water & Sewer Use)

All fittings shall be cast ductile-iron for use with ductile-iron pipe as specified above. Fittings in the 3-inch through 24-inch size range shall be pressure rated at 350 psi,
minimum; 30-inch through 48-inch size range shall be pressure rated at 250 psi, minimum; and in the 54-inch through 64-inch size range shall be pressure rated at 150 psi, minimum (except for those fittings such as plugs, caps, and sleeves which are normally rated at a higher pressure). No flanged fittings or mixtures of flanged with other end type fittings will be allowed in the range of 3-inch through 48-inch since they are not covered in the AWWA Standard. Flanged fittings conforming with and covered by this standard are allowed in sizes, 54, 60 and 64-inch. In conformance with the standard, 54, 60 and 64-inch flanged tees, crosses and reducers with outlets of smaller dimension as listed in ANSI/AWWA C153/A21.53-00 are permitted. All fittings with mechanical joints, flange joints and push-on joints shall conform to ANSI/AWWA Standard C153/A21.53-00, "Ductile-Iron Compact Fittings for Water Service". In addition, fittings with mechanical joints and push-on joints shall conform to ANSI/AWWA Standard C111/A21.11-00, "Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings" except as otherwise allowed in C153. Mechanical joint glands shall be ductile-iron only.

D. JOINTS AND ACCESSORIES

1. Push-On Type Joints (Single Gasket and Single Gasket with Gasket Restraint)

Push-on joints shall conform to ANSI/AWWA Standard C111/A21.11-00, except that the gaskets for pipe and fittings shall be neoprene where so specified.

The required number of gaskets for each push-on joint pipe plus one extra for every 50 joints or fraction thereof, shall be furnished with each order. The gaskets shall be shipped in suitable protective containers. All single gasket pipe shall be as manufactured by United States Pipe and Foundry Company (Tyton), by the American Cast Iron Pipe Company (Fastite), by McWane, Inc. (Mix of Tyton and Fastite), Tyler/Union (Tyton) or approved equal.

Push-on joints together with both their regular and gasket-restraint gaskets shall be of the design, dimensions and tolerances of either those provided by American Cast Iron Pipe Company (Fastite/Fast-Grip) or those provided by United States Pipe and Foundry Company (Tyton/Field Lok), or approved equal.

2. Mechanical Joints

Mechanical joints for fittings shall conform to ANSI/AWWA Standard C111/A21.11-00, except that the gaskets for each fitting under Groups D and D1 shall be neoprene. Bolt holes for mechanical joints shall be equally spaced, and shall straddle the vertical centerline. Tee head bolts and hexagonal nuts for all mechanical joints in fittings shall be of high strength low-alloy steel with composition, dimensions and threading as specified in ANSI/AWWA Standard C111/A21.11-00. Glands shall be of ductile-iron construction for ductile iron fittings, and cast gray iron or ductile iron for cast gray-iron fittings.

The proper number of gaskets, glands, bolts and nuts, all conforming to ANSI/AWWA Standard C111/A21.11-00, plus one extra gasket for every 10 joints or fraction there-of, shall be furnished with each order. The gaskets and joint accessories shall be shipped in suitable protective containers. Follower glands held in place with set screws will not be acceptable. Segmented glands will not be acceptable.
3. Mechanical Joint and Push-On Joint Megalug-Type Restraining Systems

Use of this type of restraint is restricted to underground mechanical joint or push-on joint applications and in general may not be used above grade or as a substitute for flanged joints. Any above grade applications will require submission of shop drawings of the piping system where they are utilized, reasoning for use, and approval from both the OWNER and ENGINEER.

In any mechanical joint or push-on joint underground piping system of 30-inch nominal diameter and below this type of restraint may be utilized as design or field conditions dictate. In sizes 36, 42 and 48-inch the prior written permission of the ENGINEER is required. In instances where written permission cannot be immediately obtained, verbal permission will be allowed but is to be confirmed in writing on the first business day following the substitution. If this type of restraint is used without permission or if permission is denied, the CONTRACTOR making the substitution shall be solely responsible for all costs, both direct and indirect, of immediately correcting the restraint system to the satisfaction of the ENGINEER.

It is recognized that flange adapters of this type form a useful tool for adjusting lengths of flanged pipe runs in instances such as runs with a large number of deflections where it is almost impossible to predict all lengths correctly. Therefore, these joints will be allowed only as indicated in the plans or with written request from the CONTRACTOR in instances where it can be clearly shown to the satisfaction of the ENGINEER that they are necessary. This application is restricted to 20-inch nominal diameter and below. Flange adapters shall be rated for a minimum working pressure of 250 psi.

The Megalug restraint systems manufactured by EBAA Iron Sales, Eastland Texas, will be considered the standard of quality for comparison purposes and the entity offering a substitute shall bear the entire burden of proving this equality to the complete satisfaction of the ENGINEER. Other manufacturers producing this type of restraint system shall submit data with their shop drawings showing that their restraint system has been in the marketplace for a minimum of three years in the U.S.

Each thrust-resistant mechanical joint or push-on joint made up with this type of restraint and the pipe and fitting of which it is a part, shall be designed to withstand an axial thrust from an internal pipeline pressure of at least 150 psi at bulkhead conditions without reduction because of its position in the pipeline nor for support from external thrust blocks.

This type of joint restraint shall not be used above grade except as previously specified nor shall it be used as a carrier pipe within a casing. This type of restraint shall not be used with tape wrapped pipe or with too great a coating thickness on the exterior of the pipe.

4. Restrained Push-on Joints (Single Gasket Non-Gasket Restrained)

Restrained joints in pipe and fittings shall be of the single gasket push-on type, and shall conform to all applicable provisions of ANSI/AWWA Standard C111/A21.11-00, except that gaskets for pipe and fittings shall be neoprene, where so specified, and the following requirements:
Thickness of the pipe barrel remaining at grooves cut, if required in the design of restrained end joints, shall not be less than the nominal wall thickness of equal sized non-restrained pipe as specified above. Restrained joints using field welding, set screws, or gaskets with expanding metal inserts will not be acceptable.

The restraining components, when not cast integrally with the pipe and fittings, shall be ductile iron or a high strength non-corrosive alloy steel.

Tee head bolts and hexagonal nuts for all restrained joints in pipe and fittings shall be of high strength low-alloy steel with composition, dimensions and threading as specified in ANSI/AWWA Standard C111/A21.11-00, except that the length of the bolts shall meet the requirements for the restrained joint design.

Each thrust-resistant joint and the pipe and fitting of which it is a part, shall be designed to withstand the axial thrust from an internal pipeline pressure of at least 150 psi at bulkhead conditions without reduction because of its position in the pipeline nor for support from external thrust blocks.

Restrained push-on joint pipe and fittings shall be capable of being deflected after assembly. During deflection, all components in the restrained system shall be in contact to provide an equal force on all contact areas.

5. Flanged Joints

Connecting pieces with one end flanged and the other end either plain-end or mechanical joint, shall conform to ANSI/AWWA Standard C110/A21.10-98. Joint material for both the flanged end and the mechanical joint accessories for connecting pieces with a mechanical joint end shall be furnished as specified.

Flange adapters shall be used only on a restricted basis and shall not be used as a general substitute for regular flanged joints, except where indicated in the plans. Flanges shall be made of ductile iron conforming with ASTM 536. Adapters shall be restrained by a number of individual gripping wedges operated by torque-limiting actuating screws.

Other types of flanged fittings, and flanged pipe, shall conform to the following requirements unless otherwise stated in the order:

Flanged fittings shall conform to ANSI/AWWA Standard C110/A21.10-98, as specified above.

Flanged ductile-iron pipe with integrally cast flanges shall be manufactured in accordance with ANSI/AWWA Standard C151/A21.51-02, and with provisions contained herein above for centrifugally cast ductile iron pipe, and shall be furnished with ANSI Standard Class 125 flanges, plain faced and drilled, conforming to ANSI Standard B16.1, "Cast Iron Pipe Flanges and Flanged Fittings", latest revision. Hollow back flanges are not acceptable.

Flanged ductile-iron pipe with threaded flanges shall be manufactured in accordance with ANSI/AWWA Standard C115/A21.15-99, "Flanged Ductile-Iron Pipe With Ductile-Iron or Grey-Iron Threaded Flanges", and shall be rated for a working pressure of 250 psi, minimum. The nominal thickness of flanged ductile-iron pipe, 6-inch and...
larger, shall not be less than those shown in Table 1 of ANSI/AWWA Standard C115/A21.15-99. The nominal thickness of 4-inch flanged ductile-iron pipe shall be Class 54 (min.) conforming to Tables 3 and 4 of ANSI/AWWA Standard C151/A21.51-02. The pipe shall be furnished with ANSI Standard Class 125 flanges, plain faced and drilled, conforming to ANSI Standard B16.1, latest revision. Hollow back flanges and grey-iron flanges shall not be acceptable for use as threaded flanges. Threaded flanges shall be individually fitted and machine tightened on the threaded pipe by the manufacturer, and shall not be interchangeable in the field. Pipe lengths shall be as ordered. Removal of flanges, cutting and re-threading the pipe, and re-installing the flanges will not be permitted in any case.

All flanges on ductile-iron pipe and fittings shall be of ductile iron. All joint materials for flanged pipe and fittings, shall be supplied with all pipe or fittings ordered. Bolts and nuts shall comply with all requirements of Appendix Section A.1 of ANSI/AWWA Standard C115/A21.15-99 except that both shall be stainless steel. Unless ring gaskets are specifically called for in the order, gaskets shall be full-faced, and gaskets shall be of 1/8-inch thickness. Gaskets shall fully conform with the requirements of ANSI/AWWA Standard C115/A21.15-99 Appendix Section A.2 except that gaskets shall be SBR for water and neoprene for sewer usage.

E. LININGS AND COATINGS

1. Asphaltic Coating

All pipe and fittings shall be outside-coated with an asphaltic material applied by means of the airless spray method. The exterior coating shall meet AWWA and MIL-C-18480 Specifications for this type of coating, shall be smooth without pinholes, thin, bare or overly thick areas. Smoothness shall be such that when hand rubbed, no “sand paper” feeling will be experienced. Coating shall be manufacturer’s standard.

2. Interior Cement-Mortar Lining

Pipe and fittings for potable water use shall be cement-lined and seal-coated in accordance with ANSI/AWWA Standard C104/A21.4-95, "Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water" and Fed Spec WW-P421-C.

F. QUALITY ASSURANCE

All pipe, fittings and other materials supplied under this contract shall be subject to inspection while still on the delivery truck. It is the sole responsibility of the vendor and supplier to make prior contact with the OWNER and provide a minimum of 48-hours prior notice of delivery.

Materials found to be defective, not in strict compliance with the quality standards of samples supplied or these specifications shall be immediately returned to the vendor at no expense of the OWNER. If defects are discovered at a later time, the vendor shall be required to remove said items and shall bare all costs for so doing together with any replacement costs. Rejection of items may subject the vendor to liquidated and/or actual damages as specified elsewhere herein.

PART 3 - EXECUTION

3.01 General
A. The CONTRACTOR shall provide all barricades and/or flashing warning lights necessary to warn of the construction throughout the Project.

B. Pipe and fittings shall at all times be handled with great care to avoid damage. In loading and unloading, they shall be lifted with cranes or hoists or slid or rolled on skidways in such manner as to avoid shock. Under no circumstances shall this material be dropped or allowed to roll or slide against obstructions.

C. All work shall be performed by skilled workmen experienced in similar installations. All pipe and fittings shall be adequately supported by clamps, brackets, straps, concrete supports, rollers or other devices as shown and/or specified. Supports or hangers shall be spaced so that maximum deflection between supports or hangers shall not exceed 0.050 inch for pipe filled with liquid, but shall not be further than 6 feet apart, whichever is closer, unless otherwise shown. All pipe supports shall be secured to structures by approved inserts or expansion shields and bolts.

D. All pipe shall be thoroughly cleaned internally before being installed. All pipes, except oxygen service, air and gas, shall be flushed with water and swabbed to assure removal of all foreign matter before installation. Air and gas piping shall be tapped with a hammer to loosen scale or other foreign matter that might be within the pipe, then thoroughly blown with a high pressure air hose. Air shall be from the CONTRACTOR’s air compressor.

E. Whenever possible, the pipe will be installed with minimum 48-inches of cover, however, due to the numerous utilities in the area, this burial could change substantially.

F. At all horizontal or vertical pipe deviation, the CONTRACTOR shall install both restrained pipe and thrust blocks. Joints may only be opened to adjust alignment by half of the AWWA or manufacturer's recommended opening (which is smaller).

G. Pipe Sleeves and Wall Castings: Pipe sleeves and wall castings shall be provided at the locations called for on the Drawings and/or specified herein. These units shall be as detailed and of the material as noted on the Drawings and/or specified herein. They shall be accurately set in the concrete or masonry to the elevations shown. All wall sleeves and castings required in the walls shall be in place when the walls are poured. Ends of all wall castings and wall sleeves shall be of a type consistent with the piping to be connected to them.

H. Tie Rods: Unless otherwise indicated on the Drawings, the size and number of tie rods for a joint or installation shall be as recommended by the manufacturer's design chart for a working pressure of 150 psi. Tie rods shall be installed as recommended by the manufacturer.

3.02 EXCAVATION FOR PIPING

A. The CONTRACTOR shall make all excavation necessary for the construction of the pipelines, connections, valves and appurtenances, to allow for the installation of the infrastructure as shown on the plans.
B. The trench shall be excavated at least 6 inches below pipe laying grade as shown on the Plans. All sheeting and shoring shall be installed at the CONTRACTOR’s expense where it is necessary for pipe installation and property protection or required by the Trench Safety Act. The cost of dewatering any excavation shall be at the CONTRACTOR’s expense. The disposal of water removed from an excavation shall be in a manner which will not create a hazard, or be detrimental to the public health or to public or private property.

C. The CONTRACTOR shall obtain all necessary permits approving the location and proposed method of disposal before discharging water from any excavation into any portion of the public right-of-way or into any existing drainage structure or facility. All construction signs required shall be provided by the CONTRACTOR.

3.03 BACKFILLING FOR PIPING

A. Suitable materials for bedding (to a depth of 6-inches below the bottom of the pipe) and initial backfill (to a depth 1-foot above the top of the pipe) for buried ductile iron, steel, HDPE, and PVC pipelines shall be composed of well graded crushed stone or gravel conforming to the following requirements:

- Retained on 1/2” sieve: 0%
- Retained on 3/8” sieve: 0-5%
- Retained on No. 4 sieve: 20-80%
- Retained on No. 10 sieve: 75-100%
- Retained on No. 20 sieve: 98-100%

B. Secondary backfill materials for all types of pipe shall generally consist of compactible soil materials removed from the trench and shall be free of brush, debris, and trash. Rocks or stones having a dimension greater than 6-inches shall be removed before material is used.

3.04 TRENCH SURFACE RESTORATION

The surface of the backfilled trench shall be restored to match the previous conditions. This shall include final grading, placement of topsoil and seeding, placement of sod, or other prepared or unprepared surfaces. Existing above grade items shall be replaced in-kind, including but not limited to fencing, concrete/asphalt surfaces, curbing, vegetation (shrubs, plantings, trees, etc.) mailboxes, signage, etc.

3.05 INSTALLATION OF PIPE, FITTINGS AND VALVES

A. All bends, tees, and plugs, unless otherwise specified, shall be backed with concrete to undisturbed ground. Provision shall be made to prevent concrete from adhering to plugs or bolts.

B. Bolts, nuts and rubber gaskets for use in flanged and mechanical joints shall be stored under cover. Gaskets shall not be exposed to heat, light or any petroleum products, shall be kept clean and shall not be handled with greasy or dirty hands.

C. Before making up flanged joints in cast iron pipe and fittings, the back of each flange under the bolt heads, and the face of each flange shall have all lumps, blisters and
excess bituminous coating removed and shall be wire brushed and wiped clean and dry.

D. Before laying the ductile iron pipe, all lumps, blisters and excess coal-tar coating shall be removed from the bell and spigot ends of each pipe and the outside of the spigot and the inside of the bell wire brushed and wiped clean and dry. The entire gasket groove area shall be free of bumps or any foreign matter which might displace the gasket. The cleaned spigot and gasket shall not be allowed to touch the trench walls or trench bottom at any time. Vegetable soap lubricant shall be applied in accordance with the pipe manufacturer's recommendations, to aid in making the joint. The workmen shall exercise caution to prevent damage to the gasket or the adherence of grease or particles of sand or dirt. Deflections shall be made only after the joint has been assembled.

E. Cutting of ductile iron pipe for inserting valves, fittings, etc., shall be done by the CONTRACTOR with a mechanical pipe saw in a neat and workmanlike manner without damage to the pipe, the lining, or the coating. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed with a file or power grinder to remove all roughness and sharp edges. The cut ends of push on joint pipe shall be suitably beveled.

F. Unless otherwise directed, ductile iron pipe shall be laid with the bell ends facing in the direction of laying; and for lines on an appreciable slope, the bells shall, at the discretion of the ENGINEER, face upgrade.

G. Push-on and mechanical joints in ductile iron pipe and fittings shall be made in accordance with the manufacturer's standards except as otherwise specified herein. Joints between push-on and mechanical joint pipe and/or fittings shall be made in accordance with AWWA Standard Specifications, "Installation of Ductile Iron Water Mains and Appurtenances," C600-87, except that deflection at joints shall not exceed one-half of the manufacturer's recommended allowable deflection, or one-half of the allowable deflection specified in AWWA C600-87, whichever is the lesser amount.

H. Flanged joints shall be used only where indicated on the Plans. Before making up flanged joints in the pipeline, the back of each flange under the bolt heads and the face of each flange shall have all lumps, blisters and excess bituminous coating removed and shall be wire brushed and wiped clean and dry. Flange faces shall be kept clean and dry when making up the joint, and the workmen shall exercise caution to prevent damage to the gasket or the adherence of grease or particles of sand or dirt. Bolts and nuts shall be tightened by opposites in order to keep flange faces square with each other, and to insure that bolt stresses are evenly distributed.

I. Bolts and nuts in flanged and mechanical joints shall be tightened in accordance with the recommendations of the pipe manufacturer for a leak-free joint. The workmen shall exercise caution to prevent overstress. Torque wrenches shall be used until, in the opinion of the ENGINEER, the workmen have become accustomed to the proper amount of pressure to apply on standard wrenches.

J. Pipe Protection

1. Paint all uninsulated metal (ductile iron or steel) piping underground with two coats of asphaltic paint.
2. Wrap soil pipe that touches metal or is exposed to masonry with a layer of 6 mil polyethylene.

3. Spirally wrap all pipe lines embedded in concrete with two layers of 30 lb. felt.

4. Coat all exposed threads on galvanized steel pipe after assembly with two coats of zinc chromate.

K. Cleaning and Testing: All of the piping installed under this project shall be tested as follows and as directed by the ENGINEER

1. All potable water piping shall be disinfected per AWWA standards.

2. No leakage shall be permitted for flanged or any other type of above ground piping.

L. Installation of Aboveground and Exposed Piping

1. Aboveground and exposed pipe fittings, valves and accessories shall be installed as shown or indicated on the Drawings.

2. Piping shall be cut accurately to measurements established at the job site and shall be worked into place without springing or forcing, properly clearing all equipment access areas and openings. Changes in sizes shall be made with appropriate reducing fittings rather than bushings. Pipe connections shall be made in accordance with the details shown and manufacturer's recommendations. Open ends of pipe lines shall be properly capped or plugged during installation to keep dirt and other foreign material out of the system. Pipe supports and hangers shall be provided where indicated and as required to insure adequate support of the piping.

3. Welded connections shall be made in conformity with the requirements of AWWA Standard C 206 and shall be done only by qualified welders. The ENGINEER may, at his option, require certificates that welders employed on the work are qualified in conformity with the requirements of this standard and/or sample welds to verify the qualifications of the welders. Before testing, field welded joints shall be coated with the same material as used for coating its pipe in accordance with the requirements of AWWA.

4. Flanged joints shall be made up by installing the gasket between the flanges. The threads of the bolts and the faces of the gaskets shall be coated with a suitable lubricant immediately before installation.

3. Use of perforated band iron (plumber's strap), wire or chain as pipe hangers will not be acceptable. Supports for pipe less than 1-1/2 inches nominal size shall not be more than 8-feet on centers and pipe 2-inches nominal size and larger shall be supported at not more than 10-feet on centers, unless otherwise indicated. Supports for PVC pipe shall be spaced one-half the distance specified above unless otherwise indicated. Any noticeable sagging shall be corrected by the addition of extra supports at the CONTRACTOR’s expense.

3.07 SHOP COATING AND LINING

A. The interior of all pipe and fittings for water service shall be cement mortar lined. The
interior of all sewer pipe and fittings shall have 1 mil of asphaltic lining.

B. Exterior surfaces of all pipe and fittings shall be asphaltic coated.

3.06 FIELD QUALITY CONTROL

A. All water mains shall be flushed to remove all sand, debris, rock and other foreign matter. Dispose of the flushing water without causing a nuisance or property damage.

B. Pressure and Leakage Testing: All pumps, piping and gauges shall be furnished, installed and operated by the CONTRACTOR and all such equipment and devices and their installation shall be approved by the ENGINEER. Pump shall be of a non-pulsating type suitable for this application and gauge accuracy certification may be required at the ENGINEER’s discretion. All pressure and leakage testing shall be done in the presence of a representative of the OWNER as a condition precedent to the approval and acceptance of the system.

END OF SECTION 15060
SECTION 15444 – HORIZONTAL SPLIT CASE PUMPS AND MOTORS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The contractor shall furnish and install two (2) single stage, double suction, horizontal split case design (split on the horizontal axis) pumps, as shown on the plans and as specified herein.

B. The specifications and drawings represent the acceptable standard of quality for equipment, materials and methods of construction.

C. The pumps shall have suction and discharge connections located on opposite sides of the lower casing, allowing removal of the rotating element without disturbing the system piping connections. Discharge shall be 8” diameter, and suction shall be 8” diameter.

D. Pump Design Information
   Flow: 1,250 US gpm
   Pump Head: 75 feet
   Minimum efficiency at design point: 75.7%
   NPSHR at design condition shall not exceed 12 feet
   Maximum Motor Horsepower: 40 HP
   Maximum Motor Speed: 1800 RPM
   Minimum Shut-Off Head: 92 feet

1.2 QUALITY ASSURANCES

A. The manufacturer of this equipment shall be one recognized and established in the design and production of horizontal split case pumps suitable for potable water use. The pump manufacturer shall maintain regular production facilities at their place of business. These facilities shall be open for inspection by a representative of the engineer/owner/contractor at any time during the construction and testing of the equipment covered under these specifications.

B. The booster pumps must be installed and undergo factory performance and hydrostatic testing in accordance with the latest revision of the Hydraulic Institute Standards prior to the station delivery.

1.3 EQUIPMENT MANUFACTURERS

A. Horizontal split case pumps shall be manufactured by Peerless, Crane-Deming, Flowserve, or preapproved equal.

B. REQUESTS FOR POST-BID APPROVALS OF ALTERNATE EQUIPMENT WILL NOT BE CONSIDERED.
C. Alternate manufacturers may be submitted for pre-bid approval in accordance with the pre-approval requirements listed in this specification. A pre-approval request must be made of the Engineer at least 14 days in advance of the bid date. A minimum of 5 days prior to the bid date, the Engineer will issue an addendum listing any manufacturers that have been pre-approved.

D. Acceptance, for bid purposes of manufacturers as pre-approved, in no way relieves any manufacturer of strictly adhering to the specification and submittal requirements.

E. PRE-BID SUBMITTAL - ALTERNATE EQUIPMENT SUBSTITUTION

The pre-bid submittal shall be provided at least fourteen (14) days before the bid and shall include all necessary information to properly determine the acceptability of the manufacturer and shall not necessarily be limited to the following:

1. Pre-bid submittals will be four (4) bound hard copies and four (4) CDs. Complete description of the equipment, system, process, or function, including a list of system components and features, drawings, catalog information and cuts, manufacturer's specifications, including materials description.

2. Pump material data, performance curves, horsepower requirements at design, and selected motor horsepower.

3. Outside utility requirements, such as water, power, air, etc.

4. Functional description of internal instrumentation and control supplied including list of parameters monitored, controlled, or alarmed.

5. Addresses and phone numbers of nearest service centers and a listing of the manufacturer's or manufacturer's representatives services available at these locations, including addresses and phone numbers of the nearest parts warehouses capable of providing full parts replacement and/or repair services.

6. A list of installation references where similar equipment by the manufacturer is currently in potable water service. These references shall be limited to only those users who have a minimum of three (3) such pieces of equipment that have been in service five (5) or more years.

7. Detailed drawings, full size 24" by 36" only, including plan and sectional views illustrating a design specific to this project and including site, architectural, structural, mechanical, plumbing, electrical, control and instrumentation details necessary to adapt the equipment or systems to the arrangement shown and/or functions described on the drawings and technical specifications prepared for this project. The drawings shall be to scale and illustrate both electrical NEC Code 110-26 clearances, pump centerlines and minimum clear space between pumps.

8. All differences between the specifications and the proposed equipment shall be clearly stated in writing under the heading of "DIFFERENCES".
1.4 RELATED WORK IN OTHER SECTIONS

A. Electrical - Division 16

1.5 SUBMITTALS

A. Shop drawings shall be submitted to the Engineer as specified in Section 01330 Submittal Procedures. Submittals shall include, but not be limited to, pump dimensions, material lists, factory verified curves for actual pumps being supplied.

B. Operation, maintenance and service manuals - Equipment manufacturers shall furnish six (6) copies of an operating and maintenance manual covering their equipment. The manual shall contain complete descriptions on operation of each item of equipment, a complete parts list with factory numbers, recommended spare parts list, and name and address, and phone numbers of nearest service center(s). It shall be bound, contain complete operating and service instructions and shall be tabbed and indexed for easy reference. Manuals shall be submitted within 60 days of final shop drawing approval.

PART 2 - PUMP AND MOTOR CONSTRUCTION

2.1 CASING

A. The pump casing material shall be a minimum of class 35 cast iron. Water passageways shall be smooth to permit maximum efficiency. Casing shall be hydrostatically tested at 150% of the maximum working pressure under which the pump could operate at design speed. The suction flange shall be drilled 125 lb. ANSI. The discharge flange shall be drilled 125 lb. ANSI.

B. The bearing brackets shall be cast as an integral part of the lower casing and have removable bracket caps. The bearing housing shall be doweled for location and anti-rotation. The pump feet shall also be cast as an integral part of the lower casing.

C. Bronze renewable casing rings shall be furnished, doweled and shouldered in the casing. Ring dowels shall be located in slots on the split surface of the lower casing.

2.2 IMPELLER

A. The impeller shall be of one piece nickel aluminum bronze, double suction type. The impeller shall be balanced, keyed to the shaft and fixed in an axial position by threaded shaft sleeves. The Impeller skirt shall be grooved and fit with close tolerances to the casing ring to permit a minimum of recirculation between the impeller and the casing ring for maximum efficiency.

B. Renewable bronze impeller rings shall be shrunk on the impeller and locked in place with stainless steel set screws. The impeller rings shall be grooved and fit with close tolerances to the casing ring for maximum efficiency.
C. Mechanical Seal - Sealing of the pump liquid cavity shall be with a face type mechanical seal with ceramic stationary seat, carbon sealing washer, Viton rubber flexible members, stainless steel metal parts and spring. Seal to be rated for 225°F (107 °C) @ 150 psig (10-34 bar) maximum. Mechanical seals shall be mounted over bronze shaft sleeves.

2.3 SHAFT AND SLEEVES

A. The shaft shall be stainless steel, adequately sized for the loads transmitted. Shaft deflection shall not exceed .002 inches at the face of the stuffing box when operating between 95% and 105% of capacity at best efficiency at the pump's maximum 60 Hz speed and with full diameter impeller.

B. The shaft shall be protected through the stuffing box by means of bronze shaft sleeves and they shall be threaded against shaft rotation and locked in place with set screws. The sleeves shall be sealed with "O" rings at the inside diameter to eliminate leakage between the shaft and sleeve. The impeller key shall be stainless steel.

2.4 BASE

A. The pump and driver shall be mounted on a common steel base (with optional drip rim). Pump and driver shall be aligned and bolted in place prior to factory shipment. Final alignment must be performed at the jobsite in accordance with the standards of the Hydraulic Institute and the pump installation, operation and maintenance instructions. Final alignment must be performed using laser alignment tools and a shaft alignment report must be supplied with start-up report. Base is to be fully grouted to eliminate vibration. Any hollow spots found after grouting that affect pump vibration will be filled at no additional cost to the owner.

2.5 COUPLING

A. A flexible coupling shall be provided between the pump and driver. A coupling guard shall be furnished over the coupling for protection. The flexible coupling shall be Falk Type T – Steelflex Grid Coupling.

2.6 PRESSURE GUAGES

A. A pressure gauge of the direct reading type, equipped with a shut-off cock and snubber, shall be provided on the discharge of each pump and in the suction side of each pump. Pressure gauge shall conform to ASME B40.1 and shall be calibrated in pounds per square inch and feet of water in not more than 5 foot increments from zero to a minimum of 10 feet above the shut-off head of the pump. Rating point shall be at approximately the mid-point of the scale.

2.7 DRIVER

A. Motors shall be premium-efficient, total enclosed fan-cooled (TEFC), squirrel cage, polyphase induction motors, exceeding the requirements of IEEE Standard 841-2009 and complying with the frame size assignments of NEMA MG 13. Motors shall be inverter duty rated for variable speed operation.

B. Enclosures – Motors are TEFC and have a degree of protection of IP55 on 143 to 5811 frame. Motor bearings have a degree of protection of IP56 via the use of a non-contact bearing isolator.
C. Service Conditions

1. Motor is suitable for continuous duty operation without derating under the following service conditions:
   a. Exposure to ambient temperatures from -25°C to 40°C
   b. Exposure to altitudes up to 1000meters (3300feet)

2. Suitable for use in indoor or outdoor applications involving severe duty conditions such as high humidity or chemical laden, corrosive or salty atmospheres.

3. Motors are capable of successfully accelerating inertia loads equal to what is specified in section 12.54 of NEMA MG 1-2009.

D. Electrical Designs

1. Motors are NEMA Design B as defined in section 1.17.1.2 of NEMA MG 1-2009.

2. Motors operate successfully at rated load under the combinations of voltage and frequency variations specified in section 12.44 of NEMA MG 1-2009.

3. Motors operate successfully under running conditions at rated load and frequency when voltage unbalance at the motor terminals does not exceed 1%.

4. Motors are premium efficient designs that exceed the efficiency values in Table 1 of IEEE Standard 841-2009 and NEMA Premium. Efficiency testing is done in accordance with IEEE standard 112, subclause 6.4 Method B. The nominal efficiency, ¾ load efficiency and guaranteed minimum efficiency are stamped on the motor’s nameplate.

5. Motors shall utilize a non-hygroscopic, chemical and humidity resistant insulation system. The thermal rating of the system is Class F as defined in section 1.66 on NEMA MG1-2009.

6. The stator windings for 1-200HP and under 600 volts are random or form wound with copper wire utilizing US Electrical Motors’ Insulife 2000 and Inverter Grade Insulation system that meets and exceeds NEMA MG1-2009 Part 31.

7. Stator is double dipped and baked in varnish to form a heavy build that exceeds the test criteria of moisture resistance per NEMA MG-1.

8. When operated at rated horsepower, voltage and frequency, the temperature rise of the stator winding does not exceed 80°C when measured by winding resistance.

9. Motors shall utilize the US Electrical Motors Inverter Grade insulation system which consists of at a minimum Class F or better insulation materials with additional phase insulating material, extra end-turn bracing and Class H spike resistant wire. The resultant system shall withstand 2400 volt transients without premature motor failure and have no cable limitations in motor application. The system will exceed NEMA MG1 Part 31 requirements.

10. Motors shall operate successfully under inverter running conditions at rated load with variation in the voltage or the frequency not exceeding the following conditions:
   a. +/-10% rated voltage at rated constant volts/hertz ratio except for specific torque boost situations.
b. Motors shall operate successfully under running conditions at rated load and volts/hertz ratio when the voltage unbalance at the motor terminals does not exceed one percent.

11. Inverter Operating Characteristics - With rated volts/hertz ratio applied, motor performance shall be as follows for critical operating characteristics:

a. Torques - Motors shall meet or exceed the minimum locked rotor (starting) and breakdown torques specified in NEMA Standard MG1 Part 12 for Design B for the rating specified when on sine wave power.

b. Currents - Locked rotor (starting) currents shall not exceed NEMA Design B values for the specified rating on 5:1 constant torque or less and variable torque motors. NEMA Design A values are allowed for 6:1 constant torque or higher value constant torque rated motors. Motors shall be capable of a 20 second stall at six times full load current without injurious heating to motor components.

12. Motors shall be rated for a 1.15 service factor on sine wave power and 1.0 service factor on VFD power in a 40C ambient.

E. Mechanical Design

1. Motors are equipped with ball bearings or roller bearings to meet the requirements of 6.5 below. Ball bearings have AFBMA C/3 clearances and shall be the same size on both ends (with exception of 440T frame - minimum 6318 on Drive end bearing).

2. Bearings are regreaseable without disassembling the fan or fan cover and provide for the elimination of purged grease through fittings extending beyond the fan cover. Polyurea thickened grease is supplied.

3. Inner bearing caps are provided for bearing retention and to prevent harmful amounts of lubricant from entering the motor interior.

4. For direct coupled motors, stabilized bearing temperature shall not exceed a temperature rise of 45C for 4 and 6 pole motors and a maximum temperature rise of 50C for 2 pole motors as measured by a thermocouple on the surface of the bearing house.

5. Bearings provide for an L-10 life of 50,000 hours per ANSI/AFBMA 9-1990 based on NEMA belting application limits per NEMA MG1-2009.

6. Enclosures have a degree of protection IP55 (per NEMA MG1-2009). VBXX Inpro Seal type Bearing isolators shall be provided on both ends of all 143 to 5811 ‘T’ frame motors to minimize entrance of moisture and contaminants into the bearing chamber.

7. Condensation drain holes with Brass Breather Drains are provided at the low points in the end brackets.

8. Frame, brackets, fan cover and conduit box are a minimum of grade 25 cast iron.

9. Rotor cage construction shall be of cast aluminum. The maximum permissible shaft runout at the end of the shaft extension of the assembled motor shall be:

a. 0.875” to 1.625” diameter inclusive TIR < 0.001

b. Over 1.626” to 6.50” diameter, TIR, 0.0015 (ball bearing) and 0.002 (roller bearing)
10. Motor mounting feet, when placed on a flat granite surface, shall not exceed 0.005” between the granite surface and the motor feet at each mounting bolt hole.

11. A drilled and tapped hole is provided in the motor frame on the same side as the conduit box for grounding purposes. Motor frame feet are flat within 0.005 inch as an assembled unit.

12. Ventilating fans are of non-sparking conductive plastic material. Most ratings use bidirectional fans. On ratings where uni-directional fans are used, the rotation of the fan is indicated by a permanent label on the outside of the motor.

13. Conduit box is diagonally split, rotatable in 90 degree increments, and twice the volume as specified in Section 11.06.2 of NEMA MG1-2009. A ground lug is provided in the box. Gaskets are provided between the conduit box and frame and between conduit box base and cover providing a moisture resistant barrier.

14. Shouldered eyebolts with a minimum safety factor or 10 are provided for motor lifting.

15. All fastening hardware is hex-head bolts or socket head cap screws with a grade 5, zinc/cadmium plating.

16. Motor cast iron components are oxide primed and painted with vinyl phenolic paint to surpass 250 hour salt spray test per ASTM B117-90.

17. Motor nameplate is stainless steel and secured with 4 stainless steel drive pins. Nameplates are capable of meeting 720 hour salt spray test per ASTM B117-90. Each nameplate contains the following information in addition to that noted in section 10.40 of NEMA MG1-2009.
   a. AFBMA bearing ID
   b. Manufacture date code
   c. Compliance with IEEE Standard 841
   d. Motor weight
   e. Guaranteed minimum efficiency
   f. Maximum space heater surface C temperature, if provided, when operating at rated voltage in a 40C ambient
   g. Balance

18. Machined frame to endshield joints are protected by an application of corrosion preventative material to the machined surfaces before assembly.

19. Corrosion protection is further enhanced by a resin and hardener that is applied to the stator, the rotor and the shaft from bearing journal to bearing journal and the exposed interior frame of the motor.

F. Production Tests – The following tests shall be performed on all motors:

1. Measurement of winding resistance

2. No load readings of current, power, and speed at rated voltage and frequency

3. Mechanical vibration check as described in 8.1, using either elastic or rigid mount

4. High potential test in accordance with section 12.03 of NEMA MG1-2009
The following test information shall be recorded and inserted in the motors’ shipment data.

1. Winding Resistance
2. No load current, voltage and speed

Motor components shall have a full five year performance warranty on sine wave power and three year warranty on inverter power. Certification of the warranties by the motor manufacturer shall be provided with the motor submittals.

PART 3 - EXECUTIONS

3.1 Installation

A. Each pump shall be installed in accordance with the written instruction of the manufacturer and under the direct supervision of the manufacturer’s representative and the impellers shall be set by the manufacturer’s representative.

B. Foundations shall be as specified on the drawings. Anchor bolts and expansion bolts shall be set accurately. Where indicated, specified, or required, anchor bolts shall be provided with square plates at least 4 inches by 4 inches by 3/8 inch or shall have square heads and washers and be set in concrete forms with suitable pipe sleeves, or both. Any templates necessary and all dimensions for setting the anchor bolts shall be furnished at the proper time. Top of the foundation shall be carefully leveled to permit the pump to hang free.

3.2 Painting and Furnishing - Unless otherwise specified all exposed ferrous metal not factory finished shall be painted as specified in Section 09900. No factory finished equipment or appurtenances shall be painted except that damaged factory finished shall be retouched in an acceptable manner with paint obtained by the manufacturer. Nameplates shall not be covered with paint but shall be cleaned and legible at completion of the work. All pumping equipment shall be painted following installation and startup.

3.3 Testing

A. Factory Pump Testing - Factory pump performance test shall be made in conformance with AWWA E101 for the following:
   1. Running test.
   3. Sample calculation from test readings.
   4. Shop inspection.
   5. Hydrostatic test of pump casing.

B. Field Requirement Test - After installation of the pumping units and appurtenances is complete, operating tests shall be carried out to assure that the pumping installation operates properly. The Contractor shall make arrangements to have the manufacturer’s field service engineer present when field equipments test are made. Each pumping unit shall be given a running field test in the presence of the Engineer for a minimum of 2 hours. Each pumping unit shall be operated at its rated capacity or such other point on its head-capacity curve selected by the Engineer. The field services engineer shall take vibration measurements in accordance with Hydraulic Institute standards. The Contractor shall provide an accurate and acceptable method of measuring the discharge flow.
C. Test shall assure that the units and appurtenances have been installed correctly, that there is no objectionable heating, vibration, or noise from any parts, and that all manual and automatic controls function properly.

D. If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted.

3.4 Manufacturer’s Field Services – The Contractor shall obtain the services of a manufacturer’s representative experienced in the installation, adjustment, and operation of the equipment specified. Manufacturer’s representative shall be regularly engaged in the installation, maintenance, and service of similar pumps and shall have a service office within 2.5 hours’ drive of the project site. The representative shall supervise the installing, adjusting, and testing of the equipment. The installation shall be certified as correct and sealed by a Professional Engineer licensed in the State of North Carolina prior to the pump station being placed into service.

END OF SECTION 15444
SECTION 16010 – ELECTRICAL BASIC REQUIREMENTS

PART 1 – GENERAL

1.1 REQUIREMENT SUMMARY

A. Furnish all labor, materials, equipment and incidentals required for a complete electrical installation for the work required under this Contract as hereinafter specified and/or shown in the Contract Documents.

B. The electrical scope of work includes but not limited to the following:

1. Demolition of Existing Electrical Service
2. Installation of New Electrical Service and Distribution Equipment
   a) New Portable Generator Quick-Connect
   b) New Transformer Concrete Pad
      (1) New Transformer provided by Owner
3. Demolition of Existing Pump Power and Control Circuitry
4. Installation of New Motor Control Center
5. Installation of New Variable Frequency Drives

C. Provide complete and functioning systems in compliance with manufacturer's instructions, performance requirements specified or shown on the Contract Documents and modifications resulting from reviewed shop drawings and field coordinated drawings.

D. The Contractor shall immediately notify the Engineer, if there are discrepancies between the Contract Documents and the related Specification Sections.

E. The work, apparatus and materials which shall be furnished under these Specifications and accompanying Contract Documents shall include all items listed hereinafter and/or shown on the Contract Documents. Certain equipment will be furnished as specified in other sections of these Specifications which will require wiring thereto and/or complete installation as indicated. All materials necessary for the complete installation shall be furnished and installed by the Contractor to provide complete power, control instrumentation, wiring, and ancillary systems as indicated on the Contract Documents and/or as specified herein.

F. It is the intent of these Specifications and Contract Documents that the electrical and control system(s) shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no extra cost.

G. Provide all temporary power as required to facilitate the Contract phased construction plan.
H. The scheduling and duration of any power or control interruption for the removal of existing equipment or the installation of new equipment shall be coordinated with the Owner.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this section, the requirements of Division 26 and those Project Specification Sections referenced therein shall be applied.

B. Related Sections include but not limited to:
   1. Division 00 - Bidding, Contract, and Conditions
   2. Division 01 - General Requirements

1.3 DEFINITIONS

A. Outdoor Areas:
   1. Those locations on the Project Site where the electrical equipment is normally exposed to wind, dust, rain, snow, etc. Outdoor areas include areas protected by a roof or rain/sun shields but not enclosed within a structure.

B. Indoor Areas:
   1. Those locations on the Project Site where the electrical equipment is normally protected from wind, dust, rain, snow, etc.

1.4 ENVIRONMENTAL CONDITIONS

A. Project Site is located on an existing Owner property.

B. Outdoor areas are considered wet locations for electrical equipment.

C. Indoor areas are considered damp and wet locations.

1.5 HAZARDOUS AREA CLASSIFICATIONS

A. There are no Hazardous Area Classifications on the Project Site.

1.6 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Iron and Steel Institute (AISI):
   4. Factory Mutual System (FM):

5. Institute of Electrical and Electronics Engineers (IEEE):
   a) 141, Recommended Practice for Electrical Power Distribution for Industrial Plants
   b) 142, Recommended Practice for Grounding of Industrial and Commercial Power Systems
   c) 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

6. National Electrical Contractors Association (NECA):
   a) NECA 1, Good Workmanship in Electrical Construction
   b) NECA 200, Recommended Practice for Installing and Maintaining Temporary Electrical Power at Construction Sites

7. National Electrical Manufacturers Association (NEMA):
   a) 250, Enclosures for Electrical Equipment (1000 V Maximum)
   b) ICS 6, Enclosures for Industrial Control and Systems

   a) 70, National Electrical Code (NEC)
   b) 70E, Standard for Electric Safety in the Workplace
   c) 79, Electrical Standard for Industrial Machinery
   d) 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities

9. Underwriters Laboratories, Inc (UL):
   a) 96A, Installation Requirements for Lightning Protection Systems
   b) 508, Industrial Control Equipment
   c) 508A, Industrial Control
   d) 698, Industrial Control Equipment for Use in Hazardous Locations

B. When a specific code or standard has not been cited, the applicable codes and standards of the following code-making authorities and standards organizations shall apply:

1. American Association of State Highway and Transportation Officials (AASHTO).
2. American Iron and Steel Institute (AISI)
3. American National Standard Institute (ANSI)
5. ETL Testing Laboratories, Inc (ETL)
6. Insulated Cable Engineers Association (ICEA)
7. Institute of Electrical and Electronic Engineers (IEEE)
8. Illuminating Engineering Society of North America (IES)
9. Instrument Society of America (ISA)
10. Lightning Protection Institute (LPI)
11. National Electrical Manufacturers Association (NEMA)
12. National Fire Protection Association (NFPA)
13. Occupational, Health and Safety Administration (OSHA)
14. Underwriters Laboratories Inc (UL)

C. In case of conflict or disagreement between codes, standards, laws, ordinances, rules, regulations, drawings and specifications, or within either document itself, the more stringent condition shall govern.

1.7 SUBMITTALS

A. Shop Drawings:

1. Shop drawings shall be arranged and labeled according to specification section and Contract Drawing.

2. Submit shop drawings prior to purchase or fabrication of equipment. See individual Division 16 sections for additional specific requirements.

3. Prior to submittals of shop drawings, coordinate electrical equipment, particularly motor control equipment, control panels, and instrumentation, with all applicable equipment and systems interfacing with that equipment.

4. Submittals shall be made in the following combinations:

a) Low Voltage Electrical Equipment (less than 1kV)

(1) Switchboards, Panelboards, Load Centers, (lighting panels), Motor Control Centers (MCC), Disconnect Switches, Transformers, Power Factor correction equipment.
b) Raceways

(1) Conduits, Cable Trays, Duct-Bank details, Man-Holes, Pull-Boxes, Junction Boxes, Conduit Bodies and Fittings.

c) Wire and Cables

(1) Feeder Circuitry power cables and conductors
(2) Branch Circuitry cables and conductors
(3) Control/Signal Circuitry
(4) Low Voltage Systems: Tele/Com, Data, Security, Video

d) Wiring Devices

(1) Receptacles, Switches

e) Wire/Cable Raceway Schedule

(1) Provide a wire or cable identification schedule for all power, control, signal, process and protective circuits. The schedule shall be submitted in an electronic spreadsheet type Excel compatible file format and include the following information at a minimum:

(a) Wire or Cable tag number.
(b) Number of conductors.
(c) Conductor size and type.
(d) Wire or Cable usage description.
(e) Conduit tag number
(f) Conduit routing (to and from).
(g) Conduit size and type.
(h) Additional notes

5. For each product, clearly identify manufacturer by name. When general data sheets are provided as part of the submittal, specifically identify the products to be used on this Project. Provide manufacturer's technical information on products to be used, including:

a) Product descriptive bulletin.

b) Electrical data pertinent to the Project and necessary to assure compliance with Specifications and Contract Drawings.
c) Equipment dimensions, where applicable.

d) Evidence that the products submitted meet the requirements of the standards referenced.

e) Specify part number with explanation of options selected.

6. Ensure that all submittals clearly indicate the equipment is UL or ETL listed.

7. For all equipment, provide manufacturer's installation instructions.

B. When a quality standard has been established by identification of a specific manufacturer or catalog number, submittals for proposed alternates and substitutions shall include:

1. Alternate and substitute equipment cross-referenced to the equipment it is replacing. Submittal shall be marked to show how differences will be accommodated.

2. Calculations and other detail data to allow determination of alternate and substitute equipment equivalency to the equipment it is replacing. Data supplied shall allow detailed comparison of all significant characteristics upon which the design equipment is based.

3. Dimensioned drawings, of the same or larger scale as the Contract Drawings, for all alternate and substitute equipment, which differs in size, configuration, service accessibility or in any significant way from the equipment it is replacing.

   a) Complete system layout, except that portion which is identical to the Contract Drawings.

   b) Redesign and modifications to all work required by the alternate or substitute equipment.

C. Operation and Maintenance Manuals.

1.8 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall unload and handle materials using methods, rigging, and equipment that will prevent damage to the materials. Care shall be used to prevent damage to painted and galvanized surfaces.

1. Bare wire rope slings shall not be used for unloading and handling materials and equipment, except with the specific written permission of the Engineer.

B. Equipment and materials, in accordance with the manufacturer’s recommendations, shall be stored, supported and protected to prevent damage.

1. Stored materials and equipment shall not be allowed to contact the ground.

2. Equipment and materials which incorporate electrical equipment or which have finished painted surfaces, and other items which would be damaged by outdoor exposure, shall be stored indoors.
a) Provide covering and shielding for all equipment to protect from damage.

b) When such storage would present an unreasonable building space or volume requirement, the equipment or materials may, when acceptable to the Engineer, be stored under weatherproof coverings on shoring or platforms.

3. All small loose items that could be easily lost, stolen, broken, or misused shall not be stored on open platforms or shoring.

4. All storage methods and schedules shall be acceptable to the Engineer.

C. Ensure that equipment is not used as steps, ladders, scaffolds, platforms, or for storage—either inside or on top of enclosures.

D. Protect nameplates on electrical equipment to prevent defacing.

E. Repair, restore or replace damaged, corroded and rejected items at no additional cost to the Owner.

F. Record Drawings:
   1. The Contractor shall maintain a marked up set of Document Drawings showing actual installed circuit numbers, conduit sizes, cable tray routing, number of conductors, conductor sizes (other than #12AWG) and all other deviations from the design drawings.
   2. All underground conduit and concealed items shall be dimensioned on the Document Drawings from permanent, visible, building features.
   3. Provide actual motor size, starter size, and heater size, along with all other protective equipment for all motor circuits as part of the one-line record drawings.
   4. Revise all wire/cable identification schedules to indicate as installed conditions.
   5. Revise all panelboard schedules to indicate as installed conditions.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

   A. Refer to related Division 16 sections. All equipment of a similar type shall be by one manufacturer unless otherwise noted in the Specifications.

2.2 MATERIALS

   A. Trade names and catalog numbers may be used in the Contract Drawings or Specifications to establish quality standards and basics of design.
1. Other listed manufacturers in the applicable specification sections with equal equipment may be acceptable.

2. If no other manufacturer is listed then any manufacturer of equal equipment may be acceptable.

B. Listed: Where UL test procedures have been established for the product type, electrical equipment shall be approved by UL or ETL and shall be provided with the UL or ETL label.

2.3 FABRICATION

A. When equipment is shop fabricated for the Project, the electrical devices and enclosures utilized shall be UL or ETL listed and labeled or shall be UL recognized.

B. Shop or Factory Finishes: Interiors of other painted equipment shall be white.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Equipment shall be installed in accordance with the requirements of the NEC.

B. Enclosures for Use with Electrical Equipment unless specifically shown or specified elsewhere in the Contract Documents:

1. NEMA 1/12:
   a. Acceptable in unclassified indoor locations.

2. NEMA 3/3R:
   a. Acceptable in damp or wet indoor/outdoor non-corrosive locations

3. NEMA 4X:
   a. Use in wet indoor/outdoor corrosive locations.

   b. Enclosures shall be 304-Stainless-Steel minimum. Enclosures constructed of 316-Stainless Steel may be required in extremely corrosive areas as shown on the Contract Drawings

   c. Nonmetallic enclosures shall not be used in areas subject to physical damage or sunlight. Nonmetallic enclosures may be used in interior locations.

4. Exceptions:
   a. As modified in other Division 16 sections.

   b. As otherwise indicated on the Contract Drawings.
C. Coordinate the installation of electrical equipment with other trades.
   1. Arrange for the building in of equipment during structure construction.
   2. Where equipment cannot be built-in during construction, arrange for sleeves, box-outs, openings, etc., as required to allow installation of equipment after structure construction is complete.

D. Verify that equipment will fit support layouts indicated.

E. Equipment Dimensions and Clearances:
   1. Equipment shall fit in the locations shown on the Contract Drawings.
   2. Do not use equipment or arrangements of equipment that reduce required clearances or exceed the space allocation.

F. Install equipment in accordance with the manufacturer’s instructions.

G. Equipment Access:
   1. Install equipment so it is readily accessible for operation and maintenance.
   2. Equipment shall not be blocked or concealed.
   3. Do not install electrical equipment such that it interferes with normal maintenance requirements of other equipment.

H. Equipment shall be installed plumbed, square and true with the building construction and shall be securely fastened.

I. Outdoor wall-mounted equipment and indoor equipment mounted on earth or water bearing walls shall be provided with corrosion-resistant spacers to maintain 1/4 IN separation between the equipment and the wall.

J. Screen or seal all openings into outdoor equipment to prevent the entrance of rodents and insects.

K. Equipment fabricated from aluminum shall not be placed in direct contact with earth or concrete.

L. Provide all necessary anchoring devices and supports.
   1. Use supports as detailed on the Drawings and as specified. Where not detailed on the Drawings or specified, use supports and anchoring devices rated for the equipment load and as recommended by the manufacturer.
   2. Supports and anchoring devices shall be rated and sized based on dimensions and weights verified from approved equipment submittals.
   3. Hardware shall be malleable type, corrosion resistant and shall be supported by heavily plated machine screws or brass, bronze or stainless steel bolts.
4. Do not cut, weld to, or modify building structural members without written approval by the Engineer of record.

5. Do not mount safety switches and external equipment to other equipment enclosures, unless enclosure-mounting surface is properly braced to accept mounting of external equipment.

M. Contractor shall verify exact rough-in location and dimensions for connection to electrical items to be installed under this Contract.

1. Shop drawings shall be secured from those furnishing the equipment.

2. Proceeding without proper information may require the Contractor to remove and replace work that does not meet the conditions imposed by the equipment supplied.

3. Provide sleeves wherever openings are required through new concrete or masonry members. Place sleeves accurately and coordinate locations with the Engineer.

4. Should any cutting and patching be required on account of failure of the Contractor to coordinate penetrations, such cutting and patching shall be done at the expense of the Contractor.

   a. Contractor shall not endanger the stability of any structural member by cutting, digging, chasing, or drilling and shall not, at any time, cut or alter the work without the Engineer's written consent.

      1) Provide additional reinforcing if required.

      2) Cutting shall be done neatly using proper tools and methods.

   b. Subsequent patching to restore walls, ceilings, or floors to their original condition shall be done by workmen skilled in their particular field.

N. Provide concrete foundations or pads required for electrical equipment as indicated or specified.

1. Floor-mounted equipment shall be mounted on a 4IN high concrete housekeeping pad. Pad shall be poured on top of the finished floor or slab.

O. Material that may cause rusting or streaking on a building surface shall not be used.

P. Perform excavation and backfill in accordance with Project Specifications.

Q. Contractor shall coordinate the installation of the conduit and wire associated with the HVAC equipment supplied under this Contract.

R. Enclosed electronic equipment located outdoors shall be provided with sun/rain shields and oriented to minimize sun exposure.
S. Device Mounting:

1. Dimensions are to top of item unless otherwise indicated.

2. Mounting heights as indicated below unless otherwise indicated on the Contract Drawings:
   a. Light switch: 48IN.
   b. Receptacle in all other locations: 48IN.
   c. Telephone outlet for desk-mounted phone: 16IN.
   d. Telephone outlet for wall-mounted phone: 64IN.
   e. Disconnect / Safety-Switch: 64IN to top of enclosure.
   f. Panelboard: 72IN to top of enclosure.
   g. Motor starter: 64IN to top of enclosure.
   h. Pushbutton motor control station: 48IN to top of enclosure.

3.2 IDENTIFICATION

A. Identify all major items of equipment including controls, panels, switches, contactors, motor starters/controllers, junction boxes and metering by permanent nameplates, with wording approved by the Engineer. Secure nameplates to equipment with stainless-steel screws or rivets. Adhesives may be used in conjunction with mechanical fasteners.

B. Nameplates after installation shall be easily visible and shall bear notations corresponding to those shown on the Record Drawings.

C. All conduits shall be identified with a stamped stainless-steel tag system. Conduit tags shall be permanently attached to each exposed end of conduit runs such as in man-holes, pull-boxes, panels, motor control centers, junction boxes, etc., and at each point of entry into a structure or building. Each tag shall be stamped with the appropriate conduit number per the conduit and cable schedules.

D. Each instrument shall be identified with a stamped stainless-steel tag system. Instrument tags shall be permanently attached to each individual instrument and stamped with the appropriate tag number per the instrument specification section.

E. Each cable shall be identified with a heat-shrinkable polyolefin label printing system. Instrumentation cables shall be labeled with the appropriate instrument tag (Example: FIT-200-1). Multiplex cables, power and control cables shall be labeled with the appropriate cable tag number per the equipment tag number (Example: PP1-CKT-9).

F. All motor control centers, power panels, lighting panels, control panels, control cabinets, etc., shall be identified with permanently mounted nameplates.
G. All power and lighting panels shall have matte-finish plastic laminated typed schedules mounted on panel doors.

H. Identification Types:

1. Equipment Nameplates:
   a. Phenolic Resin or Thermoplastic Elastomer
      1) Thickness: 3/32IN minimum.
      2) Size: As required by text.
      3) Letters: White letters on Black background.
      4) Mount with stainless-steel screws.

2. Wire and Cable Labels:
   a. Heat shrinkable Polyolefin
      1) Size: As required by wire or cable.
      2) Letters: Black letters on White background.
      3) Heat-shrink after termination.
      4) Replace damaged or illegible labels.

3. Raceway Tags:
   a. Material: Stainless-Steel
   b. Size: As required by text.
   c. Attach with stainless-steel wire and permanent crimp sleeve

4. Instrument Tags:
   a. Material: Stainless-Steel
   b. Size: As required by text.
   c. Attach with stainless-steel wire and permanent crimp sleeve

3.3 FIELD QUALITY CONTROL

A. Do not remove or damage fireproofing materials.
   1. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
   2. Repair or replace fireproofing removed or damaged.
B. Make all penetrations through roofs prior to installation of roofing.

C. All penetrations required after installation of roofing, shall be completed by an authorized roofer to maintain the roof warranty.

D. Make all penetrations of electrical work through walls water and weather-tight.

E. Equipment furnished under this Contract for use on future work and all concealed equipment, including conduits, shall be dimensioned, on the Record Drawings, from visible and permanent building features.

F. After installation, all equipment shall be tested as recommended by the manufacturer.

G. Verify all components are operational.

H. Perform ground-fault performance testing as required by NEC Article 230-95(c).

I. Test Equipment Interface:
   1. Verify systems coordination and operation.

J. Set all adjustable trip protective devices as required for system protection and coordination.

K. Verify all system and equipment ground continuity.

L. Adjust installed equipment for proper operation of all electrical and mechanical components.

M. Replace equipment and systems found inoperative or defective and re-test.
   1. If equipment or system fails re-test, replace it with products that conform to Contract Documents.
   2. Continue remedial measures and re-tests until satisfactory results are obtained.
   3. Remedial measures and re-tests will be done at no cost to the Owner.

N. The Engineer shall be notified of tests and Engineer may witness individual tests.

O. Required certificates of testing and test reports shall be presented to the Engineer upon completion of the tests.

P. At Completion of Installation:
   1. Test to ensure all equipment is free of short circuits and improper grounds.
   2. Test to ensure all equipment is operational.

3.4 CLEANING

A. Clean dirt and debris from all interior and exterior surfaces.
B. Apply touch-up paint as required to repair scratches, etc.

C. Replace nameplates or wire and cable markers damaged during installation.

D. Thoroughly vacuum the interior of all enclosures to remove dirt and debris. Do NOT use pressurized air systems to blow out dirt and debris.

3.5 DEMONSTRATION

A. Demonstrate equipment in accordance with Contract Requirements.

END OF SECTION 16010

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SECTION 16111 – CONDUIT AND RACEWAY

PART 1 – GENERAL

1.1 REQUIREMENT SUMMARY

A. The Contractor shall furnish all labor, materials, tools and equipment necessary for furnishing, installing, connecting, testing and placing into service all raceway to include all conduits, conduit fittings, wireway, supports, etc. as required for a complete electric installation as specified herein and indicated on the Contract Drawings.

B. Conduit home runs for lighting, receptacle and other misc. circuits are not necessarily indicated on the Contract Drawings; however, the circuit numbers are shown. Conduit shall be furnished and installed for these circuits.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this section, the requirements of specification Section 16010 – Electrical, Basic Requirements, and the sections referenced therein shall be applied.

B. Additional raceway from what is shown on the Contract Drawings may be required. Coordinate with the requirements of equipment provided under other Divisions of the specifications.

1.3 CODES AND STANDARDS

A. Raceway shall comply with the following applicable codes and standards as well as any others within the specifications and drawings. In the event of any conflict between these codes, regulations, standards, and Contract Documents, the most restrictive shall apply.

1. American National Standards Institute (ANSI):
   a. C80.1, Rigid Steel Conduit - Zinc-Coated.
   b. C80.3, Electrical Metallic Tubing - Zinc-Coated.
   c. C80.4 Fittings for Rigid Metal Conduit and Electrical Metallic Tubing.
   d. C80.5 Electrical Rigid Aluminum Conduit.
   e. C80.6 Electrical Intermediate Metal Conduit.

   b. A153, Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

e. A569, Steel Carbon, Hot-Rolled Sheet and Strip, Commercial Quality.

f. A570, Hot-Rolled Sheet and Strip, Structural Quality.

g. A575, Merchant Quality Hot-Rolled Carbon Steel Bars.


k. D2564, Solvent Cements for (PVC) Plastic Pipe, Tubing, and Fittings.


3. ETL Testing Laboratories, Inc (ETL).

4. National Electric Manufacturers Association (NEMA):

a. RN-1, Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

b. TC-2, Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

c. TC-6, PVC and ABS Plastic Utilities Duct for Underground Installation.

5. National Electric Contractors Association:


a. 70, National Electric Code (NEC).

b. 79, Electrical Standard for Industrial Machinery

7. Underwriters Laboratories Inc (UL):

a. 1, Flexible Metal Conduit.
b. 6, Rigid Metal Conduit.

c. 6A, Electrical Rigid Metal Conduit – Aluminum.

d. 209, Cellular Metal Floor Raceways and Fittings.

e. 360, Liquid-Tight Flexible Steel Conduit.

f. 467, Grounding and Bonding Equipment.

g. 514, Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.

h. 514B, Conduit, Tubing and Cable Fittings.

i. 651, Schedule 40 and 80 Rigid PVC Conduit.

j. 797, Electrical Metallic Tubing.

k. 870, Wireways, Auxiliary Gutters, and Associated Fittings.

l. 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

m. 1242, Intermediate Metal Conduit.

n. 1660, Liquid-Tight Flexible Non-Metallic Conduit.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Sections 16010.

2. Proposed routing of all site conduits including direct buried, concrete encased, and long run above ground conduits.

3. Proposed routing of conduits buried under floor slabs.

4. Proposed routing and details of construction, including conduit and rebar, of conduits embedded in floor slabs, columns, etc.

B. Operation and Maintenance Manuals.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS:

A. The material covered by this Specification is intended to be standard material of proven performance as manufactured by reputable firms. Raceways and appurtenances shall be
designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

B. All equipment shall be UL listed and labeled for its intended service.

C. Subject to compliance with the Contract Documents, the listed manufacturers are acceptable.

2.2 RIGID GALVANIZED STEEL CONDUIT (RGS)

A. Acceptable Manufacturers:
   1. Allied Tube and Conduit Corporation.
   2. Western Tube and Conduit Corporation.
   3. Wheatland Tube Company.

B. RGS shall be manufactured from high strength steel with continuous welded seam and shall have an external and internal metallic zinc coating applied by hot-dip galvanizing or electro-galvanizing.

C. Threads: Galvanized after cutting.

D. Standards:
   1. ANSI C80.1.

2.3 PVC-COATED RIGID GALVANIZED STEEL CONDUIT (PVC-RGS)

A. Acceptable Manufacturers:
   1. Thomas & Betts.
   2. Perma-Cote.
   3. Rob-Roy Ind.

B. PVC-RGS shall have a minimum 40MIL polyvinyl chloride exterior coating. The coating shall be bonded to hot-dipped galvanized rigid steel conduit conforming to ANSI C80.1. The bond between the polyvinyl chloride coating and the conduit surface shall be greater than the tensile strength of the coating. PVC-RGS shall have a nominal 2MIL, minimum, urethane interior coating and a urethane coating on threads. The RGS conduit: shall have an epoxy prime coating prior to application of polyvinyl chloride and urethane coatings.

C. Female ends shall have a plastic sleeve extending a minimum of 1 pipe diameter or 2IN, whichever is less beyond the opening. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used with it.
D. Standards:
   1. ANSI C80.1.
   2. NEMA RN-1.

2.4 RIGID POLYVINYL CHLORIDE CONDUIT (PVC)
A. Acceptable Manufacturers:
   1. Allied Tube and Conduit Corporation
   2. Carlon
   3. Cantex
B. PVC shall be either Schedule 40 or Schedule-80. The polyvinyl-chloride plastic compound shall meet, as a minimum, ASTM D1784 cell classification PVC 12233-A, B, or C. PVC shall be rated for direct sunlight exposure, 90°C wire, and fire retardant with low smoke emission.
C. Standards:
   1. ANSI C33.91.
   2. NEMA TC-2.
   3. UL 651.

2.5 LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFMC)
A. Acceptable Manufacturers:
   1. Anamet, Inc.
   2. Electri-Flex Company.
   3. International Metal Hose Company.
B. LFMC shall have a core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked, contain an interwoven copper strip suitable as a grounding means, and have an extruded vapor and liquid tight polyvinyl chloride outer jacket positively locked to the steel core.
C. Standard:
   1. UL 360.

2.6 WIREWAY
A. Acceptable Manufacturers:

3. Stahlin
4. Square D.

B. Wireway shall have a minimum wall thickness of 0.040IN, be furnished without knockouts, be designed for continuous grounding, and suitable for lay-in conductors. Provide Solid and non-removable covers when passing through partitions and solid hinged covers with captive screw fasteners when accessible.

C. Wireway shall not be smaller than 4 x 4IN unless otherwise indicated on the Contract Drawings.

D. Types:

1. NEMA-1: Wireway shall be steel, finished with rust inhibiting phosphatizing coating and gray baked enamel finish on interior and exterior surfaces.

2. NEMA-3/3R/12: Wireway shall be steel, finished with rust inhibiting phosphatizing coating and gray baked enamel finish on interior and exterior surfaces. Cover shall be fully gasketed and provided with captive clamp type latches.

3. NEMA- 4/4X: Wireway shall be type 304 stainless steel for interior or exterior corrosive areas. Cover shall be fully gasketed and provided with captive external screw type clamps.

4. NEMA- 4/4X: Fiberglass or PVC may be utilized for interior corrosive areas only where specifically shown on the Contract Drawings.

E. Standards:

1. NFPA 79

2. UL 870.

2.7 CONDUIT FITTINGS AND ACCESSORIES

A. Acceptable Manufacturers:

1. Appleton.
2. Carlon.
5. OZ Gedney Company.
6. Perma-Cote.
7. RACO.
8. Rob-Roy Ind.
9. Steel City.
10. Thomas and Betts.
11. Western Plastics Company.

B. Fittings for Use with RGS:

1. Materials: Following minimum requirements unless otherwise noted.
   a. Body: Malleable iron, zinc- or cadmium-plated; steel, hot-dipped galvanized; or steel zinc plated with aluminum lacquer or aluminum enamel finish.
   b. Covers: Malleable iron, zinc plated and gasketed.
   c. Gaskets: Neoprene or PVC.
   d. Insulators-phenolic, thermosetting: minimum 105 Deg C UL rating.
   e. Grounding saddles tin-plated copper or bronze suitable for use with copper and aluminum conductors.
   f. Bonding jumpers: Tinned copper flexible braid.
   g. Locknuts: Malleable iron, zinc plated.

2. All fittings: Threaded unless otherwise noted.

3. Conduit Hubs shall be cast aluminum with insulated throat.

4. Straight couplings: Same material and finish as the conduit with which they are used.

5. Expansion and/or Deflection couplings:
   a. 2 or 4IN nominal straight-line conduit movement in either direction.
   b. 30-degree nominal deflection from the normal in all directions.
c. Watertight.
d. Insulating bushing.
e. End couplings/hubs - bronze; or steel zinc-plated with aluminum cellulose lacquer finish.
f. Outer jacket-neoprene.
g. Jacket clamps-stainless steel.
h. Inner sleeve (when used) - molded plastic.

6. Service entrance heads:
   a. Weather resistant.
   b. Body: Malleable iron, hot-dipped galvanized or copper-free aluminum.

7. Mogul pulling elbows and tees:
   a. Die cast copper free aluminum.
   b. Rain tight.

8. Conduit seals:
   a. Drain and breather: Stainless steel or brass.
   b. Fiber and sealing compound: UL listed for use with the sealing fitting.

9. Standards:
   a. UL 6.
   b. UL 467.
   c. UL 514B.
   d. UL 1242.

C. Fittings for Use with PVC-RGS:
   1. The same material and construction as those fittings listed under paragraph "Fittings for Use with RGS"; and coated as defined under paragraph "PVC-RGS."

D. Fittings for Use with PVC:
1. Fittings shall be of the same material, thickness, and construction as the conduits with which they are used.
   a. Standards:
      1) UL 651.
      2) NEMA TC-2-1978.

2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
   a. Shall not be more than 1 year past date of manufacture.

E. Fittings for Use with LFMC:

1. Fittings shall meet the following minimum requirements unless otherwise noted:
   b. Ferrule: Steel, zinc-plated.
   c. Locknuts and compression nuts: Malleable iron, zinc-plated.
   d. Sealing ring: Neoprene.

2. Fittings shall be compression type.


2.8 STRUT CHANNEL SUPPORT SYSTEMS

A. Acceptable manufacturers:
   a. Allied Power-Strut Products
   b. B-Line Systems
   c. Rob-Roy Industries
   d. Thomas & Betts
   e. Unistrut Building Systems

B. All strut-channel, clamps, fittings and fastener materials shall conform to the following unless otherwise noted on the Contract Drawings.

1. Indoor Dry Areas: Hot-Dipped Galvanized Steel (ASTM A123)
2. Indoor/Outdoor Wet Areas:
   
a. PVC Coated Hot-Dipped Galvanized Steel (ASTM D1151, D2247)
   
b. Stainless Steel Type-304 (ASTM A240)
   
C. Strut-channel shall not be bent, drilled, cut or otherwise modified to produce fittings, braces or brackets for conduit and equipment supports.
   
D. Manufactured strut-channel braces, brackets, fittings and post-bases shall be provided and installed with associated hardware and fasteners as a complete system for conduit and equipment supports.

PART 3 – EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. All conduit, raceway, wireway and associated fittings shall be stored in accordance with the manufacturer recommendations and shall not be stored exposed to sunlight or other UV rays.

3.2 INSTALLATION

A. The Contractor shall plan the layout of conduit and raceway systems so that when the work is complete it will exhibit good workmanship practices in accordance with NECA-1.

B. Routing of Conduits and Raceways:
   
   1. Conduit and Raceway runs, where shown, indicate the preferred location. Site conditions may affect actual routing. Contractor shall coordinate routing and measurement with other trades and with equipment suppliers.
   
   2. Shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
   
   3. Wherever possible avoid routing conduits and raceways through areas of high ambient temperature or radiant heat.

C. Size of Conduits and Raceways:
   
   1. The size of conduits and raceways are normally shown on the Contract Drawings. If a size is not shown on the Contract Drawings, or if a minimum size is not stated in the Specifications, then the size of conduits and raceways shall be in accordance with the NEC.
   
   2. Conduits shall not be smaller than 1IN for underground installations and 3/4IN elsewhere, unless otherwise shown on the Contract Drawings.

D. Types of Conduits and Raceways:
1. Shall be installed as defined in the Contract Drawings.

2. As required by NFPA.

3. Flexible Conduit:
   a. Install as the final conduit to motors, electrically operated valves, primary elements (instrumentation), and electrical equipment that is liable to vibrate.
   b. Shall not be used as a conduit run:
   c. Maximum length shall not exceed:
      1) 48IN to motors.
      2) 24IN to all other equipment.

4. PVC-RGS:
   a. Contractor shall use tools, clamps, dies, equipment, etc. designed specifically for the cutting, bending and threading of PVC-RGS.
   b. Contractor shall follow the recommendations and methods of the manufacturer for installing PVC-RGS.

E. Provide openings in walls, floors, and ceilings for all required raceway penetrations.
   1. Sleeves and block outs: Set in masonry walls during erection.
   2. Sleeves and block outs: Set in concrete during forming.
      a. Material: Not harmful to the concrete.
      b. Not considered to replace structurally the displaced concrete.

F. Conduit Runs:
   1. All conduits within a structure shall be installed concealed unless otherwise noted on the Contract Drawings.
   2. Total of Bends in a Conduit Run:
      a. Less than 270 degrees.
      b. Provide pull boxes, condulets, or pulling elbows or tees as needed.
   3. Run in straight lines parallel to or at right angles to structural members or building lines.
4. Maintain minimum 2IN separation between all conduits.
5. Maintain minimum 6IN separation between instrumentation and power conduits.
6. Maintain minimum 12IN separation from process, gas, air and water pipes.
7. Conduits and accessories embedded in concrete:
   a. Shall not be larger in outside diameter than one-third the thickness of the slab, column or beam.
   b. Place conduit and accessories after reinforcing steel has been laid.
   c. Shall not displace the reinforcement steel.
   d. Provide a minimum of 1-1/2IN of concrete cover around conduit.
   e. Do not run against reinforcing steel.
   f. Provide 2IN minimum of spacing between conduits.
   g. Install expansion/deflection fittings wherever conduit spans structural or expansion joint.

G. Field Bending of Conduits:
   1. Utilize tools, equipment, methods and recommendations by the manufacturer to make all field bends.
   2. The internal diameter of conduit shall not be reduced or distorted.

H. Field Cutting and Threading Conduits:
   1. Utilize tools, equipment, methods and recommendations by the manufacturer to field cut and thread conduit.
   2. All field cut conduit shall be smooth and evenly chamfered on the inside.
   3. All field threaded conduit shall be clean and degreased before applying a zinc rich paint.

I. Terminating Conduits:
   1. NEMA 1G enclosures:
      a. Top: Locknuts and insulated bushings.
      b. Side: Locknuts and insulated bushings.
      c. Bottom: Locknuts and insulated bushings.
2. NEMA 2/12/12K enclosures:
   a. Top: Sealing locknuts and insulated bushings.
   b. Side: Locknuts and insulated bushings.
   c. Bottom: Locknuts and insulated bushings.

3. NEMA 3/3R/3S/13 enclosures:
   a. Top: Not Acceptable.
   b. Side: Sealing locknuts and insulated bushings.
   c. Bottom: Locknuts and insulated bushings.

4. NEMA 4/4X enclosures:
   a. Top: Not Acceptable.
   b. Side: Threaded conduit hubs with insulated throats or approved cable gland fittings located in the lower one-third portion of the enclosures.
   c. Bottom: Threaded conduit hubs with insulated throats or approved cable gland fittings.

J. Conduit Seal Installation:

1. In each conduit entering or leaving a Class I area.

2. In each conduit in a Class I Division 1 area entering or leaving an enclosure containing switches, circuit breakers, fuses, relays, resistors or other apparatus which may produce arcs, sparks or high temperature.

3. In each conduit 2IN or larger in a Class I Division 1 area entering or leaving an enclosure containing terminals, splices and taps.

4. In each conduit in a Class I Division 2 area entering or leaving an enclosure required to be approved for use in Class I environments.

5. In each conduit in a Class II location between an enclosure required to be dust ignition-proof and an enclosure that is not required to be dust ignition-proof.

6. In each conduit in a corrosive area entering or leaving that area and entering or leaving an electrical equipment enclosure in that area.

7. So that the filler plug and drain is accessible.

8. Complete with approved sealing fiber and compound.
K. Conduit Moisture Sealing:

1. All conduits terminated into enclosures located outdoors or routed from interior to exterior locations shall have:
   a. Non-hardening conduit sealing putty packed into and around conductors within each conduit opening.

L. Conduit Coatings:

1. The protective coating of metallic conduits, fittings, and accessories shall be maintained.
   a. Repair RGS utilizing a zinc rich paint.
   b. Repair PVC-RGS utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit.
       1) The total nominal thickness: 40MIL.
   c. Repair surfaces that will be inaccessible after installation prior to installation.

2. All metallic raceways installed in direct contact with concrete, masonry or soils shall be:
   a. PVC-RGS
   b. Installed with 40MIL minimum coating of cured coal-tar bitumastic paint.

3. All metallic raceway transitions through concrete, masonry or soils shall be:
   a. PVC-RGS
   b. Installed with heavy-wall heat-shrink polyolefin tubing extending 6IN minimum on each side of transition.
   c. Installed with 40MIL minimum coating of cured coal-tar bitumastic paint.

M. Power Cable Pulling Preparation

1. Remove water and debris from conduit prior to installation of power cables.
2. Pull mandrel with diameter nominally 1/4IN smaller than the interior of the conduit, to ensure circular cross-section and removal of obstructions.
3. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
4. Tightly plug ends of conduit with manufactured pipe plugs or plastic conduit inserts until power cables are pulled.

5. Only nylon or polyethylene rope shall be used to pull power cables in rigid non-metallic conduit systems.

END OF SECTION 16111
SECTION 16120 – WIRE AND CABLE

PART 1 – GENERAL

1.1 REQUIREMENT SUMMARY

A. The Contractor shall furnish, install, connect, test, and place in satisfactory operating condition, ready for service, all cables and wires indicated on the Contract Drawings and as specified herein or required for proper operation of the installation, with the exception of internal wiring provided by electrical equipment manufacturers. The work of connecting cables to equipment, machinery, and devices shall be considered a part of this Section. All hardware, junction boxes, bolts, clamps, insulators, and fittings required for the installation of cable and wires system shall be furnished and installed by the Contractor.

B. The Contractor shall submit Shop Drawings and other material required to substantiate conformance with the requirements set forth on the Contract Drawings and in Section 16010 – Electrical: Basic Requirements. Shop drawings shall include, but not be limited to, detailed specifications and product data sheets for the power, control, and instrumentation cable required for this project.

C. The wire and cable to be furnished and installed for this project shall be the product of manufacturers who have been in the business of manufacturing wire and cable for a minimum of ten (10) years.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Related Sections include but are not necessarily limited to:

1. Division 00 – General Requirements
2. Division 16 – Electrical Construction

1.3 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions, the Contractor shall obtain from the wire and cable manufacturer and submit the following:

1. Shop Drawings
2. Reports of Certified Shop and Field Tests
3. Wire and Cable Identification Methods

Each submittal shall be identified by the applicable specification section.

1.4 SHOP DRAWINGS
A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed material's compliance with the Contract Documents.

B. Partial, incomplete, or illegible Submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Material specifications and product data sheets identifying all materials used and methods of fabrication.

2. Cable and wire identification methods and materials.

1.5 IDENTIFICATION

A. Each cable or wire shall be identified as specified in Part 3, EXECUTION, of this Specification.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. The wire and cable to be furnished and installed for this Project shall be the product of manufacturers who have been in the business of manufacturing wire and cable for a minimum of ten (10) years.

B. The wire and cable shall be provided by one of the manufactures listed:

1. Anixter
2. Belden
3. ICC Industrial Cable
4. General Cable
5. Southwire
6. Superior Essex
7. Okonite Company
8. Approved Equal

2.2 POWER WIRE AND CABLE – CIRCUITS GREATER THAN 100A

A. All 600V rated power wire and cable shall consist of stranded, copper conductor with insulation type XHHW-2, 90°C
B. Circuits within the interior spaces of buildings may utilize 600V rated insulation, type THHN/THWN, 75°C.

C. Conductors shall be stranded copper per ASTM-B8, B-33 and B-189, Class B or C stranding contingent on the size unless otherwise specified. Minimum size wire shall be #12AWG.

2.3 CONTROL CABLE

A. All 600V rated control cable shall consist of stranded, copper conductor with insulation type XHHW-2, 90°C.

B. Control circuits within the interior spaces of buildings may utilize 600V rated insulation, type THHN/THWN, 75°C.

C. The individual conductors of the multiple conductor cable shall be color coded for proper identification. Color coding shall be equal to ICEA S-68-514, Table K-1. Cables shall meet requirements of IEEE-383.

D. Conductors shall be stranded copper per ASTM B-8, B-33 and B-189, Class B or C stranding contingent on the size unless otherwise specified. Minimum wire size shall be #14AWG.

2.4 INSTRUMENTATION SIGNAL CABLE (STP)

A. The instrumentation cable for analog signals shall be individually shielded twisted pair cable (STP) or individually shielded twisted multi-pair cable (M#STP, where # = number of pairs). Conductors shall be tin or alloy coated, soft, annealed copper, #16AWG minimum with a minimum of 19 strands with 600V rated insulation for 75°C. Pairs shall have 100% coverage foil shields with a #18AWG tinned copper drain wire. Outer jackets shall be chromed polyvinyl chloride.

B. Instrumentation cables shown on the Contract Drawings to be direct buried shall be UL labeled for direct buried service.

PART 3 – EXECUTION

3.1 600V CABLE INSTALLATION

A. The cable and wires shall be installed as specified herein and shown on the Contract Drawings.

B. The cables shall be terminated in accordance with the cable and/or termination product manufacturer's instructions for the particular type of cable.

C. To minimize oxidation and corrosion, wire and cable shall be terminated using an oxide-inhibiting joint compound recommended for "copper-to-copper" connections. The compound shall be Penetrox E as manufactured by Burndy Electrical, or approved equal.
D. Splices are normally not permitted in the underground duct, manhole and handhole systems. If splices are required, the Contractor shall obtain approval in writing from the Engineer prior to splicing.

1. Splicing material shall be a two-part insulating and encapsulating resin.

E. Cable and Wire Sizes

1. The sizes of cable and wire shall be as shown on the Contract Drawings, or if not shown, as approved by the Engineer. If required due to field routing, the size of conductors and respective conduit shall be shall be coordinated with and approved by the Engineer.

2. Minimum wire size within control panels, motor control centers, switchboards and similar equipment shall be #12AWG for power and #14AWG for control.

F. Number of Wires

1. The number of wires indicated on the Contract Drawings for the various control, indication, and metering circuits were determined for general schemes of control and for particular indication and metering systems.

2. The actual number of wires installed for each circuit shall, in no case, be less than the number required; however, the Contractor shall add as many wires as may be required for control and indication of the actual equipment selected for installation at no additional cost to the Owner. The addition of conductors shall be coordinated with and approved by the Engineer.

G. Wiring Identification

1. The Contractor shall meet with the Owner and/or Engineer to develop the cable and wire identification nomenclature prior to the Contractor developing the cable and wire schedule.

2. All wiring shall be identified with a unique wire or cable tag number and shall be labeled at each termination. Tag numbers shall correspond with the accepted cable and wire schedule and shall not be duplicated.

3. Cable and wire identification shall be accomplished through the use of a printer with white, polyolefin heat shrinkable wire marking sleeves.

4. All single-phase and three-phase wiring shall be color coded at each termination. The color coding is applicable to all power, control, alarm, signal, and instrumentation cables, and conductors.

5. Identify each cable (single or multi-conductor) and groups or bundles of individual single conductors in each manhole, pullbox, cable tray or other component of the raceway system.

H. Cable Bundle Identification Tags
1. The Contractor shall furnish all labor and materials and affix to each cable bundle in manholes, cable compartments, vaults, and junction/pull boxes a bronze metal tag, 1 IN diameter, with a 1/8 IN diameter hole. The bronze tag shall be stamped with the cable bundle tag number and attached with stainless steel wire by permanent crimp seal. All cable bundles shall be tagged with its approved tag number immediately after it has been pulled.

I. Cable Installation

1. All interior cable not protected by a compartment enclosure shall be run in conduit.

J. Training of Cable

1. The Contractor shall furnish all labor and material required to train cables around cable vaults within buildings and in manholes in the outdoor underground duct system. Sufficient length of cable shall be provided in each manhole and vault so that the cable can be trained and racked in an approved manner. In training or racking, the radius of bend of any cable shall be not less than the manufacturer's recommendation. All manhole cables shall be arc and fire-proofed. The training shall be done in such a manner as to minimize chaffing.

K. Connections at Control Panels, Limit Switches, and Similar Devices

1. Where stranded wires are terminated at panels, and/or devices, connections shall be made by solderless lug, crimp type ferrule or solder dipped.

2. Where enclosure sizes and sizes of terminals at limit switches, solenoid valves, float switches, pressure switches, temperature switches, and other devices make 7-strand, #12AWG, wire terminations impractical, the Contractor shall terminate external circuits in an adjacent junction box of proper size and shall install #14AWG stranded wires from the device to the junction box in a conduit. The #12 AWG field wiring shall also be terminated in the same junction box to complete the circuit.

L. Pulling Temperature

1. Cable shall not be flexed or pulled when the temperature of the insulation or of the jacket is such that damage will occur due to low temperature embrittlement. When cable will be pulled with an ambient temperature within a three day period prior to pulling of 40°F or lower, cable reels shall be stored during the three day period prior to pulling in a protected storage area with an ambient temperature not lower than 55°F and pulling shall be completed during the work day for which the cable is removed from the protected storage.

M. Color Coding

1. Unless otherwise noted on the Contract Drawings, conductor insulation shall be color coded as follows:
a) 480V AC Power:
   (1) Phase A - BROWN
   (2) Phase B - ORANGE
   (3) Phase C - YELLOW
   (4) Neutral – GREY

b) 120/208V or 120/240V AC Power:
   (1) Phase A - BLACK
   (2) Phase B - RED
   (3) Phase C - BLUE
   (4) Neutral – WHITE

c) 120VAC Control:
   (1) Ungrounded conductors – RED
   (2) Ungrounded conductors, foreign source - YELLOW.

d) 24VAC Control:
   (1) All wiring – ORANGE

e) 24VDC Power:
   (1) Positive Lead – RED
   (2) Negative Lead – BLACK

f) 24VDC Control:
   (1) Ungrounded conductors – BLUE
   (2) Grounded conductors – BLUE w/ WHITE stripe

g) Equipment Grounding Conductor:
   (1) All wiring – GREEN

2. Conductors #4AWG and smaller shall be factory color coded with a separate color for each phase and neutral, which shall be used consistently throughout the system. Larger cables shall be coded by the use of colored tape.

3.2 INSTRUMENTATION / TELEPHONE / DATA CABLE INSTALLATION
A. Grounding of cable shield shall be accomplished at one end point only.

B. Raceways exceeding 5FT and containing instrumentation / telephone / data cable shall be installed to provide the following clearances:
   1. Raceway installed parallel to raceway conductors energized at 480 through 208V shall be 18IN and 208/120V shall be 12IN.
   2. Raceway installed at right angles to conductors energized at 480V or 120/208V shall be 6IN.

C. Where practical, raceways containing instrumentation / telephone / data cable shall cross raceway containing conductors of other systems at right angles.

D. Where instrumentation / telephone / data cables are installed in panels, etc., the Contractor shall arrange wiring to provide maximum clearance between cables and other conductors. Instrumentation / telephone / data cables shall not be installed in same bundle with conductors of other circuits.

E. Additional pullboxes shall be furnished and installed for ease of cable pulling and the cable manufacturer's recommended conduit fill factor shall be followed.

F. All cable, insulation and jacket shall have adequate strength to allow for it to be pulled through the conduit systems. Sufficient conductors shall be installed to provide space and serve future equipment where shown and specified. All conductors shall be color coded and all wires shall be suitably tagged with permanent markers at each end.

3.3 TESTING

A. All testing shall be performed in accordance with the requirements of the General Conditions. The following tests are required:

   1. Shop Test
   a. Prior to the first shipment of each size of power, control, and telephone / data cable to be furnished and installed under this Contract, samples of each size of cable shall be subjected to complete physical and electrical factory production tests at the manufacturer's plant. Other cable and wiring shall be tested in accordance with the applicable ICEA Standards. Six copies of certified test data sheets shall be submitted to the Engineer for approval prior to installation at the site. Subsequent shipment of each size of wire shall be covered by certificates of compliance which shall list Contractor's name, point of delivery, reel numbers, size of wire, length of wire, and date of shipment. Certificates shall attest the wires and cables comply with specification requirements and that wires and cables are equal in every respect to wires and cables which have been successfully tested.
   b. All test data or certificates shall be notarized and submitted.
2. Field Tests

a. Field testing shall be done in accordance with the requirements specified in the General Conditions, and Section 16010, BASIC ELECTRICAL REQUIREMENTS.

b. After installation, all wires and cables shall be tested for insulation levels and continuity. Insulation resistance between conductors of the same circuit and between conductor and ground shall be tested. Testing for insulation levels shall be as follows:

1) For 600V rated power and control cable, apply 1kVDC from a Megohmeter for all 600V wires and cables installed in lighting, control, power, indication, alarm and motor feeder circuits. Testing for continuity shall be "test light" or "buzzer".

2) 600V rated instrumentation signal cable shall be tested from conductor to conductor, conductor to shield, and conductor to ground using a 260 volt-ohmmeter, or approved equal. The resistance value shall be 200 megaohms or greater.

B. Low voltage wires and cables shall be tested before being connected to motors, devices or terminal blocks.

C. Voltage tests shall be made successively between each conductor of a circuit and all other conductors of the circuit grounded.

D. If tests reveal defects or deficiencies, the Contractor shall make the necessary repairs or shall replace the cable as directed by the Engineer, without additional cost to the Owner.

E. All tests shall be made by and at the expense of the Contractor who shall supply all testing equipment.

END OF SECTION 16120
SECTION 16195 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 REQUIREMENT SUMMARY

A. The Contractor shall furnish and install the following equipment and warning labels:
   1. Equipment nameplates
   2. Conduit/Raceway markers
   3. Wire markers and Color Coding
   4. Voltage markers
   5. Warning signs

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this section, the requirements of Division 26 and those Project Specification Sections referenced therein shall be applied.

1.3 REGULATORY REQUIREMENTS

A. Conform to requirements of the National Electrical Code (NEC), NFPA 70E, and OSHA.

B. Conform to applicable requirements of the following ANSI Standards:
   2. Z535.2 Environmental and Facility Safety Signs.
   5. Z535.5 Safety Tags and Barricade Tapes (for Temporary Hazards).

1.4 SUBMITTALS

A. Submit the following in accordance with Section 01330 Submittal Procedures:
   1. Catalog Data: Submit manufacturer’s catalog literature for each product.
   2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.
   3. Samples:
a) Submit two (2) samples of each type of printed identification products applicable to the Project.

b) Submit two (2) nameplates illustrating materials and engraving quality.

4. Submit a Conduit/Raceway identification schedule for all power, control, signal, process and protective circuits. The schedule shall be submitted for Engineer review in an electronic spreadsheet type Excel compatible file format. The schedule shall include but not limited to the following data:

   a) Conduit tag number
   
   b) Conduit routing (to and from)
   
   c) Conduit size and type
   
   d) Wire or Cable tag number
   
   e) Number of conductors
   
   f) Conductor size, type and color
   
   g) Wire or Cable usage description
      (1) voltage, power, data, controls, etc.
   
   h) Contractor additional notes

5. Submit a Cable/Wire marker schedule for all power, control, signal, process and tele/comm/data circuits. The schedule shall be submitted for Engineer review in an electronic spreadsheet type Excel compatible file format. The marker schedule shall incorporate the following alpha-numeric scheme:

6. Prefix, first letter shall indicate the associated system

   A – Analogue (PLC/DCS variable signals <90V)
   C – Control (Motor/Control signals >90V)
   D – Discrete (PLC/DCS step signals <90V)
   E – Data Communications (Data Systems, EtherNet, WiFi, etc.)
   F – Fire Alarm/Annunciation (Fire Alarm Systems and Devices)
   H – PLC/DCS Communications (ModBus, Profibus, ControlNet, etc.)
   P – Power (Power feeder, branch circuits >115V)
   T – Telephone/Voice (Telephone/Voice Systems copper or fiber)
   V – Video (CCTV/Video Monitoring Systems)
   Z – Security (Security Systems)

   a) Prefix, second letter (if applicable or used)

   C – Copper Media (Copper signal conductors)
   F – Fiber Optic Media (Fiber single-mode, multi-mode, etc.)
K – High Voltage (Power feeder, branch circuits >600V)

b) Prefix, third letter (if applicable or used)

N – Non-Secured/Un-Classified (Open, non-secured/un-classified systems)
F – Secured/Classified (Closed, secured/classified systems)

c) Root, alpha-numeric lettering as required and in accordance with the P&ID unique identifiers to reflect the equipment/device.

Examples:
FIT-20, PLC-1, VFD-4500, FCV-5010

d) Suffix, numeric indexed as required to coincide with the number of cables and/or conductors used.

Examples:
0100, 0110, 0120…0900

7. Sample Cable/Wire marker format should resemble the following:

![](image)

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, and manufacturer's wiring diagrams, with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Verify electrical equipment designations and unique equipment identifiers with Engineer, Engineer’s Representative and/or Owner.

PART 2 – PRODUCTS

2.1 EQUIPMENT NAMEPLATES

A. Furnish equipment nameplates as specified and as shown on the Contract Drawings to indicate the unique equipment identifiers.

1. UV stabilized phenolic material for outdoor applications and rated for 200F.
2. White letters on Black background.
3. 6IN by 1.5IN minimum.

2.2 CONDUIT/RACEWAY IDENTIFICATION

A. Furnish conduit and raceway identification markers for all conduit, raceway, wire-way, cable-tray and wire-through, etc.

B. Provide and install flexible pressure sensitive vinyl markers with minimum 1IN by 4IN, minimum orange background and black letters that wrap around the circumference of the conduit.

C. Provide and install typewritten vinyl raceway markers as follows but not limited to:
   1. Power Systems
   2. PLC/DCS Control Systems
   3. Telephone/Voice/Data Systems
   4. Fire Alarm and Security Systems
   5. Video/CCTV Systems

D. Reference previous Section 1.4A 4.

E. Manufacturer: LEM Products, Inc., Brady, Panduit or Engineer approved equal.

2.3 WIRE MARKERS

A. Provide wire markers for but not limited to; power, control, instrumentation, fire alarm, tele/comm, video, security and video circuit wires.

B. Furnish polyolefin whole and/or split sleeve, heat-shrinkable wire markers, size as required per wire, conductor, cable, etc.

C. Locate a wire marker on each and every cable, conductor or wire at switchgear, MCC, panelboards, pull boxes, outlet and junction boxes, and at each landed termination.

D. Provide and install typewritten black lettering on white label markers as follows but not limited to:
   1. Power and lighting circuits: as-built branch circuit or feeder circuit number.
   2. Motor control circuits: as-built control wire number or equipment manufacturer's wiring diagrams.
   3. PLC/DCS signals
4. Telephone/Data Communications circuits
5. Fire Alarm and Security circuits
6. Video/CCTV circuits

E. Reference previous Section 1.4A 5.
F. Manufacturer: LEM Products, Inc., Brady, Panduit or Engineer approved equal.

2.4 WIRE/CABLE COLOR CODING

A. Color Coding

1. Unless otherwise noted on the Contract Documents, conductor insulation shall be color coded as follows:

   a. 480V AC Power:
      1) Phase A - BROWN
      2) Phase B - ORANGE
      3) Phase C - YELLOW
      4) Neutral – GREY

   b. 120/208V or 120/240V AC Power:
      1) Phase A - BLACK
      2) Phase B - RED
      3) Phase C - BLUE
      4) Neutral – WHITE

   c. 120VAC Control:
      1) Ungrounded conductors – RED
      2) Ungrounded conductors, foreign source - YELLOW.

   d. 24VAC Control:
      1) All wiring – ORANGE

   e. 24VDC Power:
      1) Positive Lead – RED
2) Negative Lead – BLACK

f. 24VDC Control:
   1) Ungrounded conductors – BLUE
   2) Grounded conductors – BLUE w/ WHITE stripe

g. Equipment Grounding Conductor:
   1) All wiring – GREEN

2. Conductors #4AWG and smaller shall be factory color coded with a separate color for each phase and neutral, which shall be used consistently throughout the system. Larger cables shall be coded by the use of colored heat-shrinkable tubing.

2.5 VOLTAGE MARKERS

A. Furnish voltage markers for transformers, switchgear, panelboards, starters, motor control centers, safety switches, pull boxes, cabinets, and conduits.

B. Provide and install flexible pressure sensitive vinyl markers with minimum 1IN by 4IN orange background and black letters.

C. Provide voltage markers with lettering indicating the highest voltage present:
   1. 120V system: 120 VOLTS
   2. 208/120V system: 208 VOLTS
   3. 120/240V and 240V systems: 240 VOLTS
   4. 480/277V and 480V systems: 480 VOLTS

D. Manufacturer: LEM Products, Inc., Brady, Panduit or Engineer approved equal.

2.6 WARNING SIGNS

A. Furnish warning signs for low-voltage and medium-voltage transformers, switchgear, switchboards, panelboards, motor starters, motor control centers, safety switches, pull boxes, and cabinets.

B. Use warning signs that conform to ANSI Z535.4 and OSHA Danger and Caution specifications.

C. Provide minimum 2IN by 4IN warning signs.

D. Provide warning signs with format and lettering as follows:
1. Signal word: DANGER

2. Signal word panel color: red with safety alert symbol.

3. Word message:

4. Hazardous Voltage

5. Shock, Burn, or Death


E. Materials:

1. For indoor applications use flexible, pressure sensitive, polyester base with polyester overlaminate.

2. For outdoor applications use aluminum signs.


PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive identification products for compliance with installation tolerances and other conditions affecting performance of the identification products. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION - GENERAL

A. Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

B. Install labels at locations for best convenience of viewing without interference with operation and maintenance of equipment.

1. Coordinate installation of identifying devices with location of access panels and doors.

2. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Install electrical identification products only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

D. Prepare, clean and/or de-grease surfaces where electrical identification product is to be placed.
3.3 EQUIPMENT NAMEPLATES

A. Install equipment nameplates on the front of each piece of new electrical equipment to include but not limited to switchgear, switchboards, motor control centers, control equipment, transformers, panelboards, lighting panelboards, safety switches, enclosed circuit breakers, etc.

B. Position equipment nameplates so they can be read from the front of the enclosure, cabinet, etc.

C. Use manufacturer's recommended adhesive for engraved tags and nameplates.
   1. Additionally, equipment nameplates shall be fastened with stainless-steel machine screws; self-tapping fasteners are not acceptable and will be rejected to include re-placement of enclosure.

3.4 CONDUIT/RACEWAY IDENTIFICATION

A. Install conduit and raceway identification in accordance with the approved Conduit/Raceway identification schedule on all but not limited to; power, control, data, fire, tele/comm, video and security systems.

B. Position Conduit/Raceway identification so they can be read from finished floor/grade visible and easily read vertically or horizontally.

C. Engineer reserves the right during project close-out procedures that Contractor re-position and/or supplement conduit and raceway identification as Engineer and/or Owner requires at no additional cost.

D. Furnish Conduit/Raceway identification for all conduit, raceway, wire-way, cable-tray and wire-through, etc. at no less than 10-FT intervals.

3.5 WIRE MARKERS

A. Install wire markers on all but not limited to; power, control, data, fire, tele/comm, video and security system conductors within all termination, splicing, marshalling, junction-box, devices, cabinets and enclosures.

B. Install wire markers within all switchgear, switchboards, motor control centers, panelboards, lighting panelboards, safety switches, etc.

C. Wire markers shall be installed on all terminated/spliced wire, cable and conductor ends regardless of the number of enclosures that they are routed through.

D. Contractor shall inspect and ensure that all wire markers match on all terminated/spliced ends and correspond with the approved Cable/Wire marker schedule.
1. Engineer reserves the right during project close-out procedures that Contractor re-install wire markers as Engineer and/or Owner requires at no additional cost.

2. Position wire markers so they can be read when opening the enclosure door and without rotating the wire/conductor when landed on terminal strips.

E. Contractor shall re-install wire markers that are blurred, smudged, ill-legible, mis-printed, damaged or soiled at no additional cost.

3.6 VOLTAGE MARKERS

A. Install voltage markers at the following locations and position markers so they can be read from floor or ground:

1. Front and rear of each free-standing low-voltage switchgear or switchboard section.

2. Front of each low-voltage transformer, panelboard, industrial control panel, motor control center, enclosed circuit breaker, safety switch, and motor controller enclosure, including those furnished with mechanical equipment.

3. Cover of each pull box containing low-voltage or medium-voltage conductors.

3.7 WARNING SIGNS

A. Install warning signs at the following locations and position signs so they can be read from floor or ground:

1. Front and rear of each low-voltage switchgear or switchboard section.

2. Front of each low-voltage transformer, switchboard, panelboard, industrial control panel, motor control center, enclosed circuit breaker, safety switch, and motor starter enclosure including those furnished with mechanical equipment.

END OF SECTION 16195
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PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY
A. The Contractor shall furnish and install, where indicated, a free-standing, dead-front type low voltage Generator Quick Connection Enclosure, utilizing generator lug and receptacle connections as specified herein, and as shown on the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE
A. In addition to the requirements specified in this section, the requirements of Division 16 and those Project Specification Sections referenced therein shall be applied.

1.3 REFERENCES
A. The low voltage Generator Quick Connection Enclosure and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards:
   1. NEMA PB-2
   2. UL Standard 891

1.4 SUBMITTALS – FOR REVIEW/APPROVAL
A. The following information shall be submitted to the Engineer:
   1. Front view elevation
   2. Floor plan
   3. Top view
   4. Single line
   5. Schematic diagram
   6. Nameplate schedule
   7. Component list
   8. Conduit entry/exit locations
   9. Assembly ratings including:
      a. Short-circuit rating
b. Voltage

c. Continuous current

10. Major component ratings including:

a. Voltage

b. Continuous current

c. Interrupting ratings

11. Cable terminal sizes

12. Product data sheets

B. Where applicable, the following additional information shall be submitted to the Engineer:

1. Busway connection

2. Connection details between close-coupled assemblies

3. Composite floor plan of close-coupled assemblies

1.5 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process

2. Wiring diagrams

3. Certified production test reports

4. Installation information

5. Seismic certification and equipment anchorage details as specified

1.6 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.7 REGULATORY REQUIREMENTS
A. The low voltage Generator Quick Connection Enclosure shall be UL labeled.

1.8 DELIVERY, STORAGE AND HANDLING
A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.9 OPERATION AND MAINTENANCE MANUALS
A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 PRODUCTS

2.1 MANUFACTURERS
A. The low voltage Generator Quick Connection Enclosure shall be provided by one of the manufactures listed:
   1. Eaton/Cutler Hammer
   2. General Electric
   3. Square D / Schneider Electric
B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these Specifications in their entirety.

2.2 RATINGS
A. The low voltage Generator Quick Connection Enclosure assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current 22kA symmetrical at rated voltage as shown on the Contract Drawings.
B. Voltage rating to be as indicated on the Contract Drawings.

2.3 CONSTRUCTION
A. The low voltage Generator Quick Connection Enclosure shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.
B. All sections of the low voltage Generator Quick Connection Enclosure shall be front and rear aligned. All protective devices shall be group mounted. Devices shall be front removable and load connections front accessible enabling low voltage Generator Quick Connection Enclosure to be mounted against a wall.
C. The low voltage Generator Quick Connection Enclosure shall be provided with load connection options to cross bus or mechanical outgoing cable terminations, which shall be suitable for copper or aluminum conductors.

D. The low voltage Generator Quick Connection Enclosure assembly shall be provided with adequate lifting means.

2.4 BUS

A. All bus bars shall be tin-plated copper. Bus ampacity of 400A to 4000A shall be based on NEMA standard temperature rise criteria of 65 degrees C over a 40 degrees C ambient (outside the enclosure).

B. Provide a full capacity neutral bus where a neutral bus is indicated on the Contract Drawings.

C. A copper ground bus (minimum 1/4 x 2IN), shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the low voltage Generator Quick Connection Enclosure.

D. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers.

2.5 WIRING/TERMINATIONS

A. The low voltage Generator Quick Connection Enclosure shall be provided with both mechanical lugs and cam-type receptacle assembly for connection of generator power phases (A, B, C), neutral and grounding conductors. All connections for phases, neutral, ground, etc., shall be clearly marked via labeling.

B. Each single pole cam-type receptacle shall be rated for no less than 400A at 90 deg C. Multiple receptacles per phase, neutral, and ground shall be utilized when amperages over 400A are requested. Contact material of the receptacle shall be composed of brass.

C. Cam-type receptacles must be suitable for use in outdoor environments.

D. Single pole Cam-type receptacles shall be UL 498 listed for Attachment Plugs and Receptacles and UL 1691.

E. Small wiring, necessary fuse blocks and terminal blocks within the Enclosure shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer’s wiring diagrams.

F. Where applicable all control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the Enclosure shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

2.6 ENCLOSURES
A. Outdoor NEMA 3R Enclosure
   1. Outdoor enclosure shall be non-walk-in and meet applicable NEMA 3R UL requirements
   2. Enclosure shall have flat roof.
   3. Provide hinged cable entry trap door to allow cable access to generator connection receptacles and lugs while maintaining Type 3R Enclosure integrity.
   4. The enclosure shall be provided with bolt-on rear covers for each section.
   5. Doors shall have provisions for padlocking.

2.7 NAMEPLATES
   A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the Contract Drawings. Nameplates shall be as required in Specification Section 16195 – Identification for Electrical Systems. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving low voltage Generator Quick Connection Enclosure designation, voltage ampere rating, short-circuit rating, manufacturer’s name, general order number, and item number.
   B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer’s wiring diagrams.

2.8 FINISH
   A. All exterior and interior steel surfaces of the Enclosure shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the Enclosure shall be ANSI 61 light gray.

PART 3 EXECUTION

3.1 FACTORY TESTING
   A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
      1. The low voltage Generator Quick Connection Enclosure shall be completely assembled, wired, adjusted, and tested at the factory. After assembly, the complete low voltage Generator Quick Connection Enclosure will be tested for operation under simulated service conditions to ensure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200V for one (1) minute between live parts and ground, and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500V for one (1) minute between live parts and ground.
   B. The manufacturer shall provide three (3) certified copies of factory test reports.
3.2 MANUFACTURER’S CERTIFICATION
   A. A certified test report of all standard production tests shall be available to the Engineer upon request.

3.3 TRAINING
   A. The Contractor shall provide a training session for up to five (5) owner’s representatives for one (1) normal workdays at a job site location determined by the Owner.
   B. A manufacturer’s qualified representative shall conduct the training session. The training program shall consist of instruction on operation of the assembly, circuit breakers, fused switches, and major components within the assembly.

3.4 INSTALLATION
   A. The Contractors shall install all equipment per the manufacturer’s instructions, contract drawings and National Electrical Code.
   B. The low voltage Generator Quick Connection Enclosure assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to Contractor supplied supports per manufacturer’s recommendations.
   C. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

END OF SECTION 16429
SECTION 16450 – GROUNDING AND BONDING

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. The Contractor shall furnish and install Grounding and Bonding systems complete in accordance with the minimum requirements established by Article 250 of the NEC. Article 250 of the NEC shall be considered as a minimum requirement for compliance with this Specification.

B. Grounding of all instrumentation and control systems shall be furnished and installed in accordance with the manufacturer/system requirements and IEEE 1100-92, Powering and Grounding of Sensitive Electronic Equipment. Conflicts shall be promptly brought to the attention of the Engineer.

C. In addition to the NEC requirements, building structural steel columns shall be permanently and effectively grounded:

D. Reference Section 16010 – Electrical, Basic Requirements.

E. Additional requirements for Grounding and Bonding are shown on the Contract Drawings.

1.2 CODES AND STANDARDS

A. All Grounding and Bonding components and the completed system shall comply with the following codes and standards as well as within the Specifications or as shown on the Contract Drawings:

   a. C2, National Electrical Safety Code (NESC)

2. Institute of Electrical and Electronic Engineers (IEEE):
   b. IEEE 142, Recommended Practice for Grounding of Industrial and Commercial Power Systems.

   a. NFPA 70, National Electric Code (NEC)

4. Underwriters Laboratories Inc (UL):
   a. 588, Grounding Equipment

1.3 SUBMITTALS
A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, SUBMITTALS, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings
2. Reports of certified field tests. Each submittal shall be identified by the applicable Specification section.

1.4 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Equipment specifications and product data sheets identifying all materials used and methods of fabrication.

2. Drawings and written description of how the Contractor intends to furnish and install Grounding and Bonding system(s).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The equipment covered by these Specifications shall be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Drawings.

2.2 GROUNDING ELECTRODE CONDUCTOR

A. A stranded bare copper or green insulated grounding electrode conductor, sized as shown in the Contract Documents or as required by the NFPA 70 shall be furnished and installed at the main service entrance disconnect switch or main service entrance overcurrent device and in accordance with the Article 250 Part-II and Part-III.

B. The ground connection shall be made at the main service entrance equipment and shall be extended to the point of entrance of the metallic water service. Connection to the water pipe(s) shall be made by a suitable ground clamp or lug connection to a plugged tee. If flanged pipes are encountered, connection shall be made with the lug bolted to the street side of the flanged connection. If there is not suitable metallic water service to the facility, the ground connection shall be made to the driven ground rods on the exterior of the building.
C. Where ground fault protection is employed, care shall be taken so that the connection of the ground and neutral does not interfere with the correct operation of the ground fault protection system.

2.3 EQUIPMENT GROUNDING CONDUCTOR

A. Equipment grounding conductors shall be sized as shown in the Contract Documents or as required by the NFPA 70 shall be furnished and installed in all raceways and in accordance with the Article 250 Part-IV.

2.4 BONDING FITTINGS

A. Grounding and Bonding connections to equipment shall be bolted. Cable end connections may be made by use of the crucible weld process or bolted type connectors. Bolted type connectors for this application shall consist of corrosion resistant copper alloy with silicone bronze bolts, nuts and lock-washers which are designed for this purpose.

2.5 GROUND RODS

A. Ground rods shall be rolled to a commercially round shape from copper-clad steel manufactured by the molten-welding process or by the electro-formed process (molecularly bonded). They shall have an ultimate tensile strength of 75,000PSI and an elastic limit of 49,000PSI. The rods shall be not less than 3/4IN diameter by 20FT in length; and the proportion of copper shall be uniform throughout the length of the rod. The copper shall have a minimum wall thickness of 0.013IN at any point on the rod.

B. The maximum resistance to ground of a driven ground rod shall not exceed 25 OHM under normally dry conditions. Where the resistance obtained with one (1) ground rod exceeds 25 OHM, additional ground rods shall be coupled, by exothermic welds. Except where specifically indicated otherwise, all exposed non current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductors in nonmetallic raceways and neutral conductors of wiring systems shall be grounded.

2.6 GROUNDING GRID

Grounding and Bonding grid(s) shall be provided as shown on the Contract Drawings for each structure and interconnected. The Grounding and Bonding grid(s) shall be installed such that the ground resistance does not exceed 5 OHM. The Grounding and Bonding grid shall be interconnected by bare copper conductors sized as shown on the Contract Drawings or if not indicated, sized to the largest service entrance ground, spliced and connected to ground rods by exothermic welds. The Grounding and Bonding conductors shall be installed after the excavations for the building have been completed and prior to the pouring of concrete for the footings, mats, etc. Copper "pigtails" shall be connected to the Grounding and Bonding grid(s) and shall enter the buildings and/or structures from the outside and shall be connected to steel members and equipment as described in this Section and as shown on the Contract Drawings.

PART 3 – EXECUTION
3.1 INSTALLATION

A. Metal surfaces where Grounding and Bonding connections are to be made shall be clean and dry. Steel surfaces shall be ground or filed to remove all scale, rust, grease, and dirt. Copper and galvanized steel shall be cleaned with emery cloth to remove oxide before making connections.

B. Grounding and Bonding conductors shall be continuous between points of connection; splices shall not be permitted.

C. Where Grounding and Bonding conductors are exposed and subject to damage from personnel, traffic, etc., conductors shall be installed in PVC SCH-80 raceways.

D. Mechanical connections shall be permitted to ground rods in “Ground Test Wells” and shall be exposed to permit maintenance and inspection for continuity and effectiveness of the Grounding and Bonding system(s).

E. Where subsurface conditions do not permit use of driven ground rods to obtain proper ground resistance, rods shall be installed in a trench or plate electrodes shall be provided, as applicable and necessary to obtain proper values of resistance.

F. Conduit:
   1. Conduit that enters equipment such as motor control centers, switchboards, switchgear, variable frequency drives, instrument and control panels, and similar equipment shall be bonded to the ground bus, where provided, and as otherwise required by the NFPA 70.

3.2 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:
   1. Witnessed Shop Tests: None required.
   2. Field Tests:
      a. Ground resistance shall be measured with a three-point, fall of potential instrument.
      b. All ground rods shall be tested after being driven and prior to connection to the grounding system. Where test results show resistance-to-ground is greater-than 25 OHM, additional ground rods shall be driven by coupling with exothermic welds. The compliance shall be demonstrated by retesting ground rod.
      c. Upon completion of installation of the grounding and bonding system, the entire system shall be tested at the ground test well(s), as indicated on the Contract Drawings. The completed system shall have less-than 5 OHM of ground resistance.
3. Documentation:
   a. All tests shall be completely documented indicating time of day, date, temperature, weather conditions, measuring instrument and all pertinent test information.
   b. All required documentation of readings indicating non-compliance, shall be submitted to the Engineer prior to and required for final acceptance of the project.

PART 4 - METHOD OF PAYMENT

4.1 All costs shall be included in the lump sum cost of the booster pump station.

END OF SECTION 16450
SECTION 16481 – LOW VOLTAGE MOTOR CONTROL CENTERS

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. This Section includes, but not be limited to, requirements for the Motor Control Center (MCC) and required control devices as shown on the Contract Drawings and specified to be part of the MCC equipment. The MCC shall be configured as 480V, 3-Phase, 4-Wire, 60Hz.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this section, the requirements of Division 16 and those Project Specification Sections referenced therein shall be applied.

1.3 REFERENCES

A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents.

B. American National Standards Institute (ANSI):

C. ASTM International (ASTM):

D. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

E. International Electrotechnical Commission (IEC):

F. International Organization for Standardization (ISO):
   1. ISO 9001, "Quality Management Systems - Requirements."
G. Military Standardization Documents (MIL):

H. National Electrical Manufacturers Association (NEMA):
1. NEMA ICS 18, "Motor Control Centers."

I. National Fire Protection Association (NFPA):
1. NFPA 70, "National Electrical Code," hereinafter referred to as NEC.

J. SAE International (SAE):

K. Underwriters Laboratories, Inc. (UL):
1. UL 50, "Enclosures for Electrical Equipment, Non-Environmental Considerations."
2. UL 498, "Standard for Attachment Plugs and Receptacles."
3. UL 508, "Standard for Industrial Control Equipment."
4. UL 845, "Motor Control Centers."

1.4 SUBMITTALS

A. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Contract Drawings and Specifications.

B. Shop Drawings: Submit shop drawings for each product and accessory required. Include information not fully detailed in manufacturer’s standard product data.

C. Wiring Diagrams: Submit wiring diagrams detailing power, signal, and control systems, clearly differentiating between manufacturer-installed wiring and field-installed wiring, and between components provided by the manufacturer and those provided by others.

D. Operation and Maintenance Manuals: Submit with the delivery of the MCC an operation and maintenance manual and one copy of the manufacturer's drawings per shipping block.

1.5 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of low voltage MCC of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of twenty-five (25) years.

2. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing low voltage MCC similar in type and scope to that required for this Project and shall be approved by the manufacturer.

B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

1. The MCC shall conform to UL 845, current revision, Canadian Standards Association (CSA), Electrical Equipment Manufacturers Association of Canada (EEMAC), NEMA ICS 18, the NEC, and the Canadian Electrical Code. The MCC shall be manufactured in an ISO 9001 certified facility.

C. Single Source Responsibility: Contractor shall procure MCC and required accessories from a single source with resources to produce products of consistent quality in appearance and physical properties without delaying the work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. The MCC shall be separated into shipping blocks no more than three vertical sections each. Shipping blocks shall be shipped on their sides to permit easier handling at the job site. Each shipping block shall include, but shall not be limited to, a removable lifting angle, which shall allow an easy means of attaching an overhead crane or other suitable lifting equipment.

B. If the MCC cannot be placed into service reasonably soon after its receipt, store it in a clean, dry, and ventilated building free from temperature extremes. Acceptable storage temperatures are from 32F (0C) to 104F (40C).

1.7 WARRANTY

A. The MCC shall be warranted to be free from defects in materials and workmanship for a period of eighteen (18) months from date of invoice from manufacturer or authorized sales channel.

B. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The MCC shall be provided by one of the manufactures listed:
   1. Allen Bradley
   2. Eaton/Cutler Hammer
   3. General Electric
   4. Square D/Schneider Electric

2.2 MATERIALS

A. Steel material shall comply with UL 845 and CSA requirements.

B. MCC shall consist of one or more vertical sections of heavy gage steel bolted together to form a rigid, freestanding assembly. A removable 7-gage structural steel lifting angle shall be mounted full width of the MCC shipping block at the top. Removable 7-gage bottom channel sills shall be mounted underneath front and rear of the vertical sections extending the full width of the shipping block. Vertical sections shall be made of welded side-frame assembly formed from a minimum of 12-gage steel. Internal reinforcement structural parts shall be of 12-gage and 14-gage steel to provide a strong, rigid assembly. The entire assembly shall be constructed and packaged to withstand normal stresses included in transit and during installation.
   1. MCC shall have right-handed mains section with top and bottom conduit entries for feeder raceway terminations.

2.3 FINISH

A. Steel parts shall be provided with UL and CSA listed acrylic/alkyd baked enamel paint finish or triglycidyl isocyanurate (TGIC) powder coat, except plated parts used for ground connections. Painted parts shall undergo a multi-stage treatment process, followed by the finishing paint coat.

B. Pre-treatment shall include, but shall not be limited to, the following:
   1. Hot alkaline cleaner to remove grease and oil.
   2. Iron phosphate treatment to improve adhesion and corrosion resistance.

C. The paint shall be applied using an electro-deposition process to ensure a uniform paint coat with high adhesion.
D. The standard paint finish shall be tested to UL 50 per ASTM B117 with no greater than 0.125IN loss of paint from a scribed line.

E. Paint color shall be #49 medium light gray per ANSI Z55.1 on all surfaces unless specified otherwise. Control station plates and escutcheon plates shall be painted a contrasting gray. Unit interior saddles shall be painted white for better visibility inside the unit.

2.4 STRUCTURES

A. Structures shall be totally enclosed, deadfront, freestanding assemblies. Structures shall be capable of being bolted together to form a single assembly.

B. The overall height of the MCC shall not exceed 90IN, not including base channel or lifting angle. Base channels, 1.5IN in height, and lifting angles, 3.0IN in height, shall be removable. The total width of one section shall be 20IN.

C. Structures shall be NEMA/EEMAC Type 1G.

1. Each 20IN wide standard section shall have all the necessary hardware and bussing for modular plug-on units to be added and moved around. Unused space shall be covered by hinged blank doors or appropriate cover plate and equipped to accept future units. Vertical bus openings shall be covered by manual bus shutters.

2. Each section shall include, but shall not be limited to, a top plate (single piece or two-piece). NEMA/EEMAC Type 12 shall also include a bottom plate. Top and bottom plates shall be removable for ease in cutting conduit entry openings.

2.5 WIREWAYS

A. Structures shall contain a minimum 12IN high horizontal wireway at the top of each section and a minimum 6IN high horizontal wireway at the bottom of each section. These wireways shall run the full length of MCC to allow room for power and control cable to connect between units in different sections.

B. A full-depth vertical wireway shall be provided in each MCC section that shall accept modular plug-on units. The vertical wireway shall connect with both the top and bottom horizontal wireway. The vertical wireway shall be 4IN wide minimum with a separate hinged door. Access to the wireways shall not require opening control unit doors. Structures that house a single, full section control unit are not required to have vertical wireways. Those control units shall open directly into the MCC horizontal wireways.
2.6 BARRIERS

A. Power bussing and splice connections shall be isolated from the unit compartments and the wireways. The horizontal bus shall be mounted onto a glass-filled polyester support assembly that shall brace the bus against the forces generated during a short circuit. The horizontal bus shall be isolated from the top horizontal wireway by a two-piece rigid non-conductive barrier. The barrier design shall allow qualified personnel to slide the barriers both left and right, to allow access to the bus and connections for maintenance without having to remove the barrier. Barrier sliding shall occur via an upper and lower track system.

B. The vertical bus shall be housed in a molded glass-filled polyester support that shall provide bus insulation and shall brace the bus against the forces generated during a short circuit. These supports shall have openings every 3IN (76mm) for unit stab-on connections. Each opening shall be provided with a manual shutter to close off the stab opening. These shutters shall be attached to the structure so that when they are removed (to allow a stab connection) they shall be retained in the structure and shall be readily accessible for use should a plug-in unit be removed from the MCC.

2.7 BUSSING

A. Bussing and connectors shall be tin-plated copper.

B. The main horizontal bus shall be rated as shown on the Contract Drawings, continuous and shall extend the full length of the MCC. Bus ratings shall be based on 149F (65C) maximum temperature rise in a 104F (40C) ambient. Provisions shall be provided for splicing additional sections onto either end of the MCC.

C. The horizontal bus splice bars shall be pre-assembled into a captive bus stack. This bus stack shall be installed into the end of the MCC power bus to allow the installation of additional sections. The main bus splice shall utilize four bolts, two on each side of the bus split, for each phase. Additional bolts shall not be required when splicing higher amperage bus. The splice bolts shall secure to self-clenching nuts installed in the bus assembly. It shall be possible to maintain any bus connection with a single tool.

D. Each section that accepts plug-in units shall be provided with a vertical bus for distributing power from the main bus to the individual plug-in starter units. This bus shall be of the same material and plating as the main bus, and shall be rated at 300A continuous. The vertical bus shall be connected directly to the horizontal bus stack without the use of risers or other intervening connectors. It shall be possible to maintain the vertical to horizontal bus connection with a single tool. Nut-and-bolt bus connections to the power bus shall not be permitted. When a back-to-back unit arrangement is utilized, separate vertical bus shall be provided for both the front and rear units.
E. A tin-plated copper ground bus shall be provided that shall run the entire length of the MCC. The ground bus shall be 0.25IN by 2.0IN and shall be rated for 600A. A compression lug shall be provided in the MCC for #4/0AWG through 250kcmil ground cable. The ground bus shall be provided with six (6) 0.38IN holes for each vertical section to accept user-supplied ground lugs for any loads requiring a ground conductor.

F. Each vertical section shall have a copper vertical ground bus that shall be connected to the horizontal ground bus. This vertical ground bus shall be installed so that the plug-in units engage the ground bus prior to engagement of the power stabs and shall disengage only after the power stabs are disconnected upon removal of the plug-in unit.

G. The system shall be rated for an available short circuit capacity of 65kA rms.

2.8 TYPICAL UNIT CONSTRUCTION

A. Units with circuit breaker disconnects rated through 400A frame, and fusible switch disconnects rated through 400A, shall connect to the vertical bus through a spring reinforced stab-on connector. Units with larger disconnects shall be connected directly to the main horizontal bus with appropriately sized cable or riser bus.

B. Conducting parts on the line side of the unit disconnect shall be shrouded by a suitable insulating material to prevent accidental contact with those parts.

C. Unit mounting shelves shall include, but shall not be limited to, hanger brackets to support the unit weight during installation and removal. Plug-on units shall use a twin-handle camming lever located at the top of the bucket to rack in and out the plug-on unit. The cam lever shall work in conjunction with the hanger brackets to ensure positive stab alignment.

D. A lever handle operator shall be provided on each disconnect. With the unit stabs engaged onto the vertical phase bus and the unit door closed, the handle mechanism shall allow complete ON/OFF control of the unit. Circuit breaker operators shall include, but shall not be limited, a separate tripped position to clearly indicate a circuit breaker trip condition. It shall be possible to reset a tripped circuit breaker without opening the control unit door. Clear indication of disconnect status shall be provided, by adhering to the following operator handle positions:

1. Handle ON position shall be up or to the left and within 45-degrees of being parallel to the face of the equipment.
2. Handle OFF position shall be down or to the right and within 45-degrees of being parallel to the face of the equipment.
3. The minimum separation between the ON and OFF positions shall be 90-degrees.
4. On circuit breaker disconnects, the handle tripped position shall be perpendicular to the face of the equipment ± 30-degrees. Minimum separation between on and tripped shall be 30-degrees. Minimum separation between tripped and off shall be 45-degrees.
E. A mechanical interlock shall prevent the operator from opening the unit door when the disconnect is in the ON position. Another mechanical interlock shall prevent the operator from placing the disconnect in the ON position while the unit door is open. It shall be possible for authorized personnel to defeat these interlocks.

F. A non-defeatable interlock shall be provided to prevent installing or removing a plug-on unit unless the disconnect is in the OFF position.

G. The plug-in unit shall have a grounded stab-on connector which shall engage the vertical ground bus prior to, and shall release after, the power bus stab-on connectors.

H. Provisions shall be provided for locking disconnects in the OFF position with up to three padlocks.

I. Handle mechanisms shall be located on the left side to encourage operators to stand to the left of the unit being switched.

J. Unit construction shall combine with the vertical wireway isolation barrier to provide a fully compartmentalized design.

K. Surfaces (back, side, and bottom plates) of the unit interior shall be painted white.

2.9 COMPONENTS FOR TYPICAL UNITS

A. Motor Starters:
   1. Magnetic starter NEMA Size 3 shall be equipped with double-break silver alloy contacts. The starter must have straight-through wiring. Each starter shall have a minimum of one (1) normally open auxiliary contact. Motor starter of NEMA Size 3 shall be protected by Motor Circuit Protector (MCP) having an ampacity of 150A
   2. Coils shall be of molded construction for NEMA Size 3. All coils to be color-coded for size 3 and permanently marked with voltage, frequency and part number
   3. Overload relays shall be an ambient compensated bimetallic-type with interchangeable heaters, calibrated for 1.0 and 1.15 service factor motors. Electrically isolated normally open and normally closed contacts shall be provided on the relay. Visual trip indication shall be standard. A test trip feature shall be provided for ease of troubleshooting and shall be conveniently operable without removing components or the motor starter. Overload to have (+/-) 24% adjustability, single-phase sensitivity, isolated alarm contact, and manual or automatic reset
   4. Each starter shall be equipped with a fused control power transformer, two (2) indicating lights, Hand-Off-Auto (HOA) selector switch, and two (2) normally open contacts, unless otherwise scheduled on the drawings. A unit-mounted device panel shall have space to accommodate six (6) 30 mm oil-tight pilot-control devices or indicating ammeters,
voltmeters, or elapsed time meters. In order to improve maintenance capabilities, the device panel shall withdraw with the unit. Door-mounted pilot devices are not acceptable.

B. Terminal Blocks:

1. When Type B wiring is specified, starter units shall be provided with unit control terminal blocks.

2. Terminal blocks shall be the pull-apart type with a minimum rating of 250V and 10A. Current carrying parts shall be tin-plated. Terminals shall be accessible from inside the unit when the unit door is opened. Terminal blocks shall be DIN rail-mounted with the stationary portion of the block secured to the unit bottom plate. The stationary portion shall be used for factory connections, and shall remain attached to the unit when removed. The terminals used for field connections shall face forward so they can be wired without removing the unit or any of its components.

3. When Type C wiring is specified, starter units shall be provided with unit control terminal blocks as described for Type B wiring along with power terminal blocks for Size 1-3 units. An additional set of terminal blocks shall be provided in a terminal compartment located in each section. These terminal blocks shall be pre-wired to the unit terminals so that field control connections can be made at the terminal compartments.

C. Pilot Device Panel: Each combination starter unit shall be proved with a hinged/removable control station plate, which can accommodate up to three 30mm pilot devices. The control station plate can be deleted if no local unit pilot devices are required.

2.10 OVERCURRENT DEVICES

A. Circuit Breakers

1. Individual feeder breakers shall have a minimum interrupting capacity of 22kAIC at rated voltage or as scheduled on the drawings. The feeder breakers used in the Motor Control Center as shown in the Contract Documents are listed below:
   a. 70A Thermal Magnetic Circuit Breaker
   b. 40A Thermal Magnetic Circuit Breaker

2.11 QUALITY CONTROL

A. The entire MCC shall go through a quality inspection before shipment. This inspection shall include, but shall not be limited to, the following:

1. Physical Inspection of the following:
   a. Structure.
   b. Electrical conductors, including, but not limited to, the following::
1) Bussing.
2) General wiring.
3) Units.

2. Electrical Tests:
   a. General electrical tests shall include, but shall not be limited to, the following:
      1) Power circuit phasing.
      2) Control circuit wiring.
      3) Instrument transformers.
      4) Meters.
      5) Ground fault system.
      6) Device electrical operation.
   b. AC dielectric tests shall be performed on the power circuit.

3. Markings/labels include, but shall not be limited to, the following:
   a. Instructional type.
   b. UL/CSA.
   c. Inspector's stamps.

4. The manufacturer shall use integral quality control checks throughout the manufacturing process to ensure that the MCC meets operating specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Contractor shall examine the existing spaces and conditions under which the work is to be installed, and notify the Engineer in writing of any conditions detrimental to the proper and timely completion of the work.

3.2 INSTALLATION

A. Install low voltage industrial MCC in accordance with reviewed product data, final shop drawings, manufacturer’s written instructions and recommendations, and as indicated on the Contract Drawings.

B. MCC shall not be placed in hazardous locations. The area chosen shall be well ventilated and totally free from humidity, dust, and dirt. The temperature of the area shall be no less than 32F
(0C) and no greater than 104F (40C). For indoor locations, protection shall be provided to prevent moisture entering the enclosure.

C. MCC shall be located in an area with a minimum of 3FT of free space in front of front-of-board construction. A minimum of 2.0IN space shall be provided between the back of front-of-board MCC and a wall, 6IN required for damp locations.

D. The MCCs shall be assembled in the factory on a smooth level surface so that sections are properly aligned. The Contractor shall provide a smooth and level concrete equipment pad for MCC installation.

3.3 DEMONSTRATION

A. Provide the services of a factory-authorized service representative of the manufacturer to provide start-up service and to demonstrate and train the Owner’s personnel.
   1. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
   2. Train the Owner’s personnel on procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventive maintenance.
   3. Review data in operation and maintenance manuals with the Owner’s personnel.
   4. Schedule training with the Owner, through the Engineer, with at least seven day’s advanced notice.

3.4 PROTECTION

A. Contractor shall provide final protection and maintain conditions in a manner acceptable to the MCC manufacturer that shall ensure that the low voltage MCC shall be without damage at time of Substantial Completion.

END OF SECTION 16481
SECTION 16483 – VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. This Specification Section provides requirements for 50HP Adjustable Frequency Drives, Variable Frequency Drives or herein identified as AC DRIVES for use with those AC motors as shown in the Contract Documents and listed below:

1. Booster Pump Motor No.1 40hp
   a) Not Installed under this Contract (future)

2. Booster Pump Motor No.2 40hp

3. Booster Pump Motor No.3 40hp

B. Contractor shall confirm and verify all nameplate pump motor data with the pumping equipment supplier prior to procurement of the AC Drives.

C. Contractor shall provide and install the AC DRIVES and all associated appurtenances for the equipment as referenced in the Contract Drawings:

D. AC DRIVES shall fit in those existing locations as shown in the Contract Drawings and not exceed the base dimensions for the equipment listed:

E. All power and control wiring shall enter the bottom of the AC DRIVES.

1. AC DRIVES shall operate with motor power conductors as shown on the Contract Drawings.

F. Any exceptions/deviations to this Specification shall be indicated in writing to the Engineer and submitted with the quotation.

G. AC DRIVES shall operate auxiliary equipment such as seal water valves, motor space heaters, and include safety and equipment protection interlocks as shown in the Contract Documents and as required by the pumping equipment supplier requirements.

H. The AC DRIVE manufacturer shall be responsible for providing all equipment specified under this section, and furnishing the equipment to the Contractor for installation.

I. The AC DRIVE manufacturer shall furnish, field test, adjust and certify all installed AC DRIVES for satisfactory operation.

1.2 REFERENCES

A. NFPA-70 National Electric Code (NEC®)

B. ANSI C84.1 Electric Power Systems and Equipment - Voltage Ratings (60Hz)
C. CSA® C22.2 No.14-95 Industrial Control Equipment

D. UL508A Standard for Safety for Industrial Control Panels

E. UL508C Standard for Safety for Power Conversion Equipment

F. NFPA 79 Electrical Equipment of Industrial Machines/Industrial Machinery

G. NEMA ICS7 Industrial Control and Systems: Adjustable Speed Drives

H. NEMA ICS7.1 Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems

I. NEMA 250 Enclosures for Electrical Equipment (1000V maximum)

J. IEC 61800-2 Adjustable speed electrical power drive systems - Part 2: General requirements - rating specifications for low voltage adjustable frequency AC power drive systems

K. IEC 61800-3 Adjustable speed electrical power drive systems - Part 3: EMC product standard including specific test methods

L. IEC 61800-5-1 Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy

M. IEC 61800-6 Adjustable speed electrical power drive systems - Part 6: Guide for determination of types of load duty and corresponding current ratings.

N. EGSA 101P Engine Driven Generator Sets - Performance Standard

O. IEEE 519 Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

1.3 SUBMITTALS

A. Approval drawings shall be furnished for Engineer review prior to factory assembly of the AC DRIVE. These drawings shall consist of elementary power and control wiring diagrams and enclosure outline drawings. The enclosure drawings shall be provided in AutoCAD® electronic format to include front and side views of the enclosures with overall dimensions and weights shown, conduit entrance locations and nameplate legend details.

B. Standard catalog sheets showing voltage, horsepower, maximum current ratings and recommended replacement parts with part numbers shall be furnished for each different horsepower rated AC DRIVE provided.

1.4 WARRANTY

A. The manufacturer shall provide the Warranty for all the Allen-Bradley branded products and related services from a local authorized Allen-Bradley distributor and/or service provider. The manufacturer shall guarantee that the equipment furnished is suitable for
the purpose intended and free from defects of design, material and workmanship and shall provide the Warranty from the date the equipment has been placed in service. The Warranty shall provide a minimum two (2) years of standard coverage to include but not limited to equipment failure to perform as specified, the manufacturer shall promptly repair or replace the defective equipment without any cost to the Owner (including handling and shipment costs).

B. QUALITY ASSURANCE

1. The manufacturer of the AC DRIVE shall be a certified ISO 9001 facility.

2. The AC DRIVE and all associated optional equipment shall be UL LISTED according to UL508C Power Conversion Equipment. A UL label shall be attached inside each enclosure as verification.

3. The AC DRIVE shall be designed constructed and tested in accordance with NEMA, NEC, VDE, IEC standards.

4. Every power converter shall be tested with an actual ac induction motor, 100% load and temperature cycled within an environmental chamber at 104°F. Documentation shall be furnished to verify successful completion at the request of the engineer.

5. All DRIVE door mounted pilot devices shall be tested to verify successful operation. Documentation shall be furnished upon written request of the engineer.

6. The AC DRIVE shall undergo QA test procedures and be submitted to a hi-pot test with all enclosed devices mounted and wired, prior to shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The AC DRIVE shall be provided by one of the manufactures listed:

1. Allen-Bradley

B. Alternate control techniques other than Pulse Width Modulated (PWM) are not acceptable.

2.2 FEATURES

A. Certifications

1. Listed to UL508C and CAN/CSA-C22.2 No. 14-05

3. Electric Power Research Institute. Certified compliant with standards SEMI F47 and IEC 61000-4-34

B. Hardware

1. Utilize SCR bridge on the input rectifier.
2. Utilize switching logic power supply operating from the DC bus.
3. Incorporate phase-to-phase and phase-to-ground MOV protection on the AC input line.
4. Microprocessor based inverter logic shall be isolated from power circuits.
5. Utilize latest generation IGBT inverter section.
6. Battery receptacle for Lithium battery power to the Real Time Clock.
7. Additional DPI port for handheld and remote Human Interface Module (HIM) options.

C. Control Functions

1. Ability to operate with motor disconnected “No Load Testing”.
2. Provide a controlled shut down, when properly protected, with no component failure in the event of an output phase to phase or phase to ground short circuit. Provide annunciation of the fault condition.
4. Provide multiple acceleration and deceleration rates.
5. Adjustable output frequency up to 650Hz.

D. EtherNet/IP Control

1. Ability to provide ON-OFF control of the AC DRIVE.
2. Ability to control outputs and manage status information locally within the AC DRIVE.
3. Ability to function stand-alone or complimentary to supervisory control.
4. Ability to speed reaction time by processing in the AC DRIVE.

5. Ability to provide scaling, selector switches, or other data manipulations not already built into the AC DRIVE.

6. Ability to read inputs/write outputs and exclusively control the AC DRIVE.

7. Ability to provide an option for decision making if communication is lost with main controller.

8. Ability to control other AC DRIVE via a peer-to-peer EtherNet/IP network.

9. Ability to write programs off-line.

E. Motor Control Modes

1. Selectable Sensorless Vector, Flux Vector, V/Hz, and Adjustable Voltage Control modes selectable through programming.

2. The AC DRIVE shall be supplied with a Start-up and Auto-tune mode.

3. The V/Hz mode shall be programmable for fan curve or full custom patterns.

4. Capable of Open Loop V/Hz.

F. Current Limit

1. Programmable current limit from 20-160% of rated output current.

2. Current limit shall be active for all drive states: accelerating, constant speed and decelerating.

3. AC DRIVE shall employ PI regulation with an adjustable gain for smooth transition in and out of current limit.

G. Acceleration / Deceleration

1. Accel/Decel settings shall provide separate adjustments to allow either setting to be adjusted from 0-3600sec.

2. A second set of remotely selectable accel/decel settings shall be accessible through digital inputs.

H. Speed Profiles

1. Programming capability shall allow the user to produce speed profiles with linear acceleration/deceleration or "S-Curve" profiles that provide changing accel/decel rates.

2. S-Curve profiles shall be adjustable.
I. Adjustments

1. A digital interface can be used for all set-up, operation and adjustment settings.
2. All adjustments shall be stored in nonvolatile memory (EEPROM).
3. No potentiometer adjustments shall be required.
4. EEPROM memory for factory default values shall be provided.
5. Software must be available for trending and diagnostics, as well as online and offline programming functionality.

J. Process PID Control

1. AC DRIVE shall incorporate an internal process PI regulator with proportional and integral gain adjustments as well as error inversion and output clamping functions.
2. The feedback shall be configurable for normal or square root functions. If the feedback indicates that the process is moving away from the set-point, the regulator shall adjust the drive output until the feedback equals the reference.
3. Process control shall be capable of being enabled or disabled with a hardwire input. Transitioning in and out of process control shall be capable of being tuned for faster response by preloading the integrator.
4. Protection shall be provided for a loss of feedback or reference signal.

K. Skip Frequencies

1. Three adjustable set points that lock out continuous operation at frequencies which may produce mechanical resonance shall be provided.
2. The set points shall have a bandwidth adjustable from Maximum Reverse Speed to Maximum Forward Speed.

L. Fault Reset / Run

1. AC DRIVE shall provide up to (9) automatic fault reset and restarts following a fault condition before locking out and requiring manual restart.
2. The automatic mode shall not be applicable to a ground fault, shorted output faults and other internal microprocessor faults.
3. The time between restarts shall be adjustable from 0.5-30sec.

M. Run on Power Up
1. A user programmable restart function shall be provided to allow restart of the equipment after restoration of power after long duration power outages. Restart time dependent on presence of incoming signal.

N. Flying Start

1. AC DRIVE shall be capable of determining the speed and direction of a spinning motor and adjust its output to "pick-up" the motor at the rotating speed. This feature is disabled by default.

O. Fault Memory

1. The last (32) fault codes shall be stored and time stamped in a fault buffer.

2. Information about the AC DRIVE condition at the time of the last fault such as operating frequency, output current, dc bus voltage and (27) other status conditions shall be stored.

3. A power-up marker shall be provided at each power-up time to aid in analyzing fault data.

4. The last (32) alarm codes shall be stored and time stamped for additional troubleshooting reference.

P. Protective Features:

1. AC Drives shall have input surge protection utilizing MOV’s, spark gaps, and Zener diodes to withstand surges of 2.3 times line voltage for 1.3mSEC.

2. AC DRIVE shall include circuitry to detect phase imbalance and phase loss on the input side of the AC Drive.

3. AC Drive shall auto-derate the output voltage and frequency to the motor if an input phase is lost. This result will maintain operation without decreasing the life expectancy of the AC Drive. The use of this feature shall be user selectable and export a warning during the event.

4. Printed circuit boards shall be conformal coated to reduce the corrosion effect from environmental gases and other conditions. The conformal coating must meet IEC 61721-3-3, Class 3C2 as standard and the AC Drive shall have an optional 61721-3-3, Class 3C3 coating available.

5. Automatic “No-Flow Detection” shall be available to detect a no-flow situation in pump systems where all valves can be closed. This shall be functional in closed loop control or when controlled by an external signal.

6. Dry-pump detection shall be available to detect if the pump has run dry. If this condition occurs, the drive will be safely stopped. A timer shall be included to prevent nuisance tripping.
7. End-of-Pump curve detection shall stop motor when the pump is operating outside of its programmed pump curve.

8. AC Drive shall provide a flow compensation program to reduce energy by adjusting the set-point to match changes in flow (friction loss).

9. AC Drives shall include current sensors on all three-output phases to detect and report phase loss to the motor. The AC Drive will identify which of the output phases is low or lost.

Q. Motor Overload Protection

1. AC DRIVE shall provide internal motor overload protection.

2. Motor overload protection shall be speed sensitive and adjustable.

3. A viewable parameter shall store the overload usage.

R. Terminal Blocks

1. Separate terminal blocks shall be provided for control and power wiring.

2. I/O terminal blocks shall be removable with wiring in place.

S. Input and Output

1. The Input / Output modules shall consist of both analog and digital I/O.

2. No jumpers or switches shall be required to configure digital inputs and outputs.

3. All digital input and output functions shall be fully programmable.

4. The control terminal blocks shall be rated for 115VAC.

5. Inputs shall be optically isolated from the drive control logic.

6. The control interface card shall provide input terminals for access to fixed AC DRIVE functions that include start, stop, external fault, speed, and enable.

7. The AC DRIVE shall be capable of supporting up to (8) analog inputs, (8) analog outputs, (16) digital inputs, (8) relay outputs, (8) transistor outputs, and (3) Positive Temperature Coefficient (PTC) inputs.

8. The Input / Output modules shall have the following features:

9. Analog Inputs:

   a) Quantity (2) differentially isolated, ±10V (bi-polar) / 11 bit plus sign, 88kOHM input impedance, 4-20mA or 1-5V.
b) Analog inputs shall be user programmable for a variety of uses including frequency command and process loop input. Analog inputs shall be user programmable for function scaling (including invert), offset, signal loss detect and square root.

10. Analog Outputs:
   a) Quantity (2) ±10V (bi-polar) / 11 bit & sign, 2kOHM minimum load, 4-20 mA, 11 bit plus sign, 400kOHM maximum load.
   b) The analog output shall be user programmable to be proportional to one of (14) process parameters including output frequency, output current, encoder feedback, output power.
   c) Programming shall be available to select either absolute or signed values of these parameters.

11. Digital Inputs:
   a) Quantity (4) digital inputs rated 24VDC/115VAC.
   b) All inputs shall be individually programmable for multiple functions including: Start, Run, Stop, Auxiliary Fault, Speed Select, Jog and Process PI functions.

12. Digital Outputs:
   a) Minimum (2) relay output (N.O. or N.C.).
   b) For 240VAC or 24VDC, N.O. contact output ratings shall be 2A max., general purpose (inductive)/resistive. N.C. contact output ratings shall be 2A max., resistive only.
   c) Relays shall be programmable to multiple conditions including: Fault, Alarm, At Speed, Drive Ready and PI Excess Error.
   d) Timers shall be available for each output to control the amount of time, after the occurring event, that the output relay actually changes state.
   e) Minimum (1) transistor output.
   f) For 24VDC, transistor output rating shall be 1A max, Resistive.

T. Reference Signals
   1. AC DRIVE shall be capable of using the following input reference signals:
   2. Analog inputs
   3. Preset speeds
4. Remote potentiometer
5. Digital MOP
6. Human Interface Module
7. Communication modules

U. Loss of Reference

1. AC DRIVE shall be capable of sensing reference loss conditions.
2. In the event of loss of the reference signal, the AC DRIVE shall be user programmable to the following:
3. Fault AC DRIVE and coast to stop.
4. Issue a minor fault - allows the AC DRIVE to continue running while some types of faults are present.
5. Alarm and maintain last reference.
6. When using a communications network to control the AC DRIVE, the communications adapter shall have these configurable responses to network disruptions and controller idle (fault or program) conditions:
   a) Fault
   b) Stop
   c) Zero Data
   d) Hold Last State
   e) Send Fault Configuration

V. Metering

1. At a minimum, the following parameters shall be accessible through the Human Interface Module (HIM):
   a) Output Current in Amps
   b) Output Voltage in Volts
   c) Output Power in kW
   d) Elapsed MWh
   e) DC Bus Voltage
f) Frequency

g) Heatsink Temperature

h) Last eight (32) faults

i) Elapsed Run Time

j) IGBT Temperature

W. Faults

1. At a minimum, the following faults shall be accessible through the HIM:
   a) Power Loss
   b) Undervoltage
   c) Overvoltage
   d) Motor Overload
   e) Heat Sink Over-temperature
   f) Maximum Retries
   g) Phase to Phase and Phase to Ground Faults

X. Predictive Diagnostics

1. At a minimum, the following predictive diagnostic features shall be provided:
   a) Relay Output Life Cycles based on load type and amps.
   b) Hours of Fan Life based on load and ambient temperature.
   c) Motor Bearing life based on expected hours of use.
   d) Motor Lubrication schedule based on hours of use.
   e) Machine Bearing life based on expected hours of use.

Y. Real-Time Clock

1. Shall be capable of providing time stamped events.

2. Shall have the ability to be set locally or via a remote controller.

3. Shall provide the ability to be programmable for date, MM:DD:YYYY and local time zones HH:MM:SS.
2.3 AC DRIVE SYSTEM

A. Enclosure

1. AC Drive shall be housed in a mild steel NEMA-1G rated enclosure.

2. AC Drive enclosure door shall have an external interlocked disconnect operator handle.
   a) Handles shall be lockable with up to (3) lock-out/tag-out padlock positions.

3. Internal disconnect shall utilize power rated fuses sized as required.

4. AC DRIVE shall match the Available Interrupting Current (AIC) and Short Circuit Current Rating (SCCR) of the existing equipment as referenced in the Contract Drawings:

5. AC DRIVE shall have external heat sink to help with cooling. A heat sink thermistor shall be monitored by microprocessor over-temperature trip device.

B. Voltage

1. Capable of accepting the nominal existing electrical power system of 480VAC 3PH @ 60Hz.

2. The supply input voltage tolerance shall be ± 10% of nominal line voltage.

C. Sizing

1. AC DRIVE shall be rated based on continuous output amps, and matched to meet or exceed the nameplate-rated Motor Full Load Amps (FLA).

2. Overload current rating of each AC DRIVE System shall be rated appropriately for the application.

D. Displacement Power Factor

1. AC DRIVE shall be capable of maintaining a minimum true power factor (Displacement P.F. X Distortion P.F.) of 0.95 lagging or better at rated load and nominal line voltage, over the entire speed range.

2. AC DRIVES shall operate with the utility power system to include the back-up generator. AC DRIVE shall not produce a leading power factor during any point in operation.

E. Harmonic Mitigation

1. The AC Drive shall provide internal DC link reactors to minimize power line harmonics and to provide near unity power factor. DC Link reactor shall be installed so that power fluctuations to the DC Capacitors shall be reduced to
increase Capacitor life. VFD’s without a DC link reactor shall provide a 5% impedance line side reactor and provide spare capacitors.

F. Efficiency

1. A minimum of 96.5% (+/- 1%) at 100% speed and 100% motor load at nominal line voltage.

2. Control power supplies, control circuits, and cooling fans shall be included in all loss calculations.

3. Operating ambient temperature range without derating: 0°C-40°C (32°F-104°F)

4. Operating relative humidity range shall be 5-95% non-condensing.

5. Operating elevation shall be up to 1000M (3,300FT) without derating.

G. Communications

1. AC DRIVE shall be capable of supporting the following network options:
   a) EtherNet/IP

H. Human Interface Module (HIM)

1. AC DRIVE shall provide a HIM with integral LCD display, operating keys and programming keys.

2. An enclosure door-mounted HIM, rated NEMA/UL Type 4/12, shall be provided.

3. The HIM shall have the minimum following features:
   a) A (7) line by (21) character backlit LCD display with graphics capability.
   b) Shall indicate AC DRIVE operating conditions, adjustments and fault indications.
   c) Shall be configured to display in the following (3) distinct zones:
      (1) The top zone shall display the status of direction, AC DRIVE condition, fault / alarm conditions and Auto/Manual mode.
      (2) The middle zone shall display AC DRIVE output frequency.
      (3) The bottom zone shall be configurable as a display for either programming menus / information or as a (2) line user display for two additional values utilizing scaled units.
   d) Shall provide digital speed control.
e) The keypad shall include programming keys, AC DRIVE operating keys (Start, Stop, Direction, Jog and Speed Control), and numeric keys for direct entry.

I. Control Power Transformer

1. Provide a control power transformer mounted and wired inside of the AC DRIVE enclosure.

2. The control power transformer shall be rated for the all AC DRIVE power requirements and control circuitry.

J. Auxiliary Relays

1. Provide relays for Drive Alarm, Drive Fault, Drive Run, and System Status Faults (as required).

2. The relays shall be (2 N.O. & 2 N.C.). The relay contacts shall be rated for 115VAC/30VDC, 5A resistive, 2.5A inductive.

K. Control Interface

1. The control terminals shall be rated for 115V AC.

2. The control interface shall provide input terminals for access to AC DRIVE functions that include start, stop, external fault, speed-select, and enable, as required.

L. Motor Space Heater Control

1. The AC DRIVE shall provide the control circuitry to energize an existing motor space heater whenever the motor is not running via internal power.

2. The motor space heater control shall be interlocked with the AC DRIVE and shall be energized whenever the motor is not running

3. A pilot light with LED (30mm), NEMA Type 4/13 shall be mounted on the AC DRIVE enclosure door for indication of Motor Heater On.

M. Auto Reset/Run

1. For faults other than those caused by a loss of power or any other non-critical fault, AC DRIVE shall provide a means to automatically clear the fault and resume operation.

N. Ride-Through

1. The AC DRIVE system shall attempt to ride through power dips up to 20% of nominal. The duration of ride-through shall be inversely proportional to load. For outages greater than 20%, AC DRIVE shall stop the motor and issue a power
loss alarm signal to a process controller, which may be forwarded to an external alarm signaling device.

O. Run on Power Up

1. AC DRIVE shall provide circuitry to allow for remote restart of equipment after a power outage. Unless indicated in the Contact Drawings, faults due to power outages shall be remotely resettable. AC DRIVE shall indicate a loss of power to a process controller, which may be forwarded to an external alarm signaling device. Upon indication of power restoration the process controller will attempt to clear any faults and issue a run command, if desired.

P. Hand/Off/Auto Mode Selector Switch

1. Provide a "HAND-OFF-AUTO" selector switch, mounted on the enclosure door.

2. The "Hand/Off/Auto" selector switch shall start the AC DRIVE in the “Hand” mode and stop the AC DRIVE in the “Off” mode.

3. In the “Auto” mode the AC DRIVE shall be started and stopped from a remote “RUN” contact.

4. In all modes, Auxiliary and Enable inputs to the AC DRIVE control interface board must be present before the AC DRIVE will start.

5. When a HIM is present, the stop function shall always be available to stop the AC DRIVE regardless of the selected mode (“Hand” or “Auto”). The HIM will be non-functional (except for the display and programming) when the switch is in “Off” mode. The HIM shall stop the AC DRIVE if the switch is in the “Auto” mode with the remote start contact initiated.

6. The AC DRIVE speed reference shall be controlled from the HIM, unless a separate door-mounted potentiometer is provided, when in “Hand” mode (factory default setting).

7. The AC DRIVE speed reference shall be controlled by a remote 4-20mA input when in “Auto” mode.

Q. The device shall be (30mm), NEMA Type 4/13, mounted on the AC DRIVE enclosure door.

R. Disable Mushroom Push Button

1. Provide a maintained mushroom style push button, mounted on the enclosure door that when pushed, will open the drive enable input.

2. The device shall be (30mm), NEMA Type 4/13, mounted on the AC DRIVE enclosure door.

S. Pilot Lights
1. Provide LED pilot lights, mounted on the enclosure door, for indication of the following status:
   a) Run
   b) Drive Fault
   c) Control Power On
   d) Motor Fault

2. Devices shall be (30mm), NEMA Type 4/13, mounted on the AC DRIVE enclosure door.

T. Motor Run Time Meter
   1. Provide a digital, non-resettable, door-mounted elapsed time meter.
   2. The meter shall be electrically interlocked with the Drive Run relay to indicate actual motor operating hours.

U. Thermistor Motor Protection
   1. Provide thermistor module for motor over-temperature and under-temperature protection.
   2. Each module shall monitor up to (4) motor mounted thermistors and shall have (3) output relays for alarm, trip and fault minimum.
   3. Customer contacts shall be rated 5A 250VAC resistive.

PART 3 - EXECUTION

3.1 INSPECTION
   A. Verify that the location is ready to receive work and the dimensions are as indicated.
   B. Do not install AC DRIVE equipment until the building environment can be maintained within the service conditions required by the manufacturer.

3.2 PROTECTION
   A. Before and during the installation, the AC DRIVE equipment shall be protected from site contaminants and debris in accordance with the manufacturer’s recommendations.

3.3 INSTALLATION
   A. Installation shall comply with manufacturer's instructions, drawings and recommendations.
B. The associated Pump System supplier will be responsible for the installation, start-up and testing for all the equipment specified herein to include (2) occurrences for each AC DRIVE and Pump installation and (1) occurrence for the completed Pump System. The Pump System supplier shall certify in writing that all the equipment has been installed, adjusted, and tested in accordance with the manufacturer’s recommendations.

3.4 TRAINING

A. The AC DRIVE manufacturer shall arrange for an on-site training course of minimum of (2) training days, provided by a representative of the AC DRIVE manufacturer plant and/or maintenance personnel.

END OF SECTION 16483
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