PROJECT MANUAL

FOR THE

WASTEWATER TREATMENT FACILITIES ALKALINITY FEED ADDITION
Project No. 1419
For the City of
WATERTOWN, SOUTH DAKOTA

BID OPENING DATE
January 30, 2015

ENGINEER – HDR
6300 S. Old Place, Suite 100
Sioux Falls, SD 57108-2102
Phone – (605) 977-7740
Facsimile – (605) 977-7747

MAYOR & CITY COUNCIL

Mayor Steve Thorson

Mr. Don Roby  Mr. Michael Danforth
Mr. Bill Rieffenberger  Mr. Jon Solum
Ms. Beth Mantey  Mr. Alvin Meisenheimer
Mr. Randy Tupper  Mr. Bruce Buhler
Mr. Russ Wilkins  Mr. Dan Albertsen
I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of South Dakota.

Allan D. Erickson
01/06/2015

Pages or sheets covered by this seal:

Divisions 00, 01, 02, 11, 13
Specification Sections 10400, 15060, 15061, 15063, 15064, 15067, 15090, 15100, 15102, 15104, 15106, 15114

I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered Professional Architect under the laws of the State of South Dakota.

Keith R. Kirchner
01/06/2015

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Sections 03002, 03131, 05505
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<td>John Rickert                                             01/06/2015</td>
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<td>Kyle L. Ganskop                                             01/06/2015</td>
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*Project No. 1419*

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INVITATION TO BID  
WASTEWATER TREATMENT FACILITIES ALKALINITY FEED ADDITION  
PROJECT NO. 1419

Sealed Bids will be received at the office of the City Finance Officer until 10:00 AM on Friday the 30th day of January, 2015 for the above referenced Project for the City of Watertown, South Dakota.

At or shortly after the time named above and within City Hall, such Bids will be publicly opened, read aloud, and referred to the City Engineer for review. Bids will be passed upon by the City at a subsequent meeting of the City Council.

The Project includes the construction of a new Alkalinity Feed Building at the existing Wastewater Treatment Facility. The alkalinity feed system to be constructed with the building will utilize sodium hydroxide for alkalinity addition and will include bulk unloading, bulk storage (FRP tank) a chemical feed pumping system and other required system and building components.

All Work on this project shall be substantially completed by the 30th day of November, 2015.

Each bid shall be accompanied by a Bid Security as described in the Bidding Documents. The Successful Bidder shall be required to provide Payment and Performance Bonds as described in the Bidding Documents.

Bidding Documents may be procured or examined at the office of the City Engineer. The City Engineer may be contacted at 23 2nd Street NE, PO Box 910, Watertown, SD 57201-0910, telephone (605) 882-6202, facsimile (605) 882-5264.

The City reserves the right to reject any and/or all Bids as set forth in the Bidding Documents.

Dated at Watertown, South Dakota this 15th Day of January, 2015.

BY: Rochelle Ebbers, CPA  
Finance Officer

PUBLISH: January 17th and 24th, 2015

Published twice at the approximate cost of $__________.
1. BIDDING DOCUMENTS

1.01 GENERAL – The Bidding Documents include a description of the contemplated Work, the location of the Project, and an estimated quantity for each Bid Item. The Bidding Documents include the Invitation to Bid, Instructions to Bidders, the Bid Form, all Addenda, and the proposed Contract Documents. The Engineer makes copies of the Bidding Documents available for the sole purpose of obtaining Bids for the Project and does not confer any license or grant for their use in any other manner.

1.02 ERRORS IN THE BIDDING DOCUMENTS – Bidders shall promptly notify the Engineer whenever conflicts, errors, ambiguities, discrepancies, and the like are discovered in or between the Bidding Documents, a Bidder’s specific knowledge concerning the Project Site, and/or any other information available to a Bidder. Where conflicts, errors, ambiguities, discrepancies, and the like exist in or between the Bidding Documents, the Bidder’s examination of the Project, and/or any other information available to the Bidder, and are not resolved by the Engineer before the Bid opening because of insufficient time or otherwise, the Bidder shall in the preparation of its Bid include the greater quantity or better quality of Work, and/or comply with the more stringent requirement resulting in the greater cost.

2. BIDDERS EXAMINATION OF THE PROJECT

2.01 GENERAL – Bidders shall be required to thoroughly examine and understand ALL Bidding Documents before submitting a Bid for the Project. Bidders shall further be required to investigate and become familiar with the existing conditions present at the Project Site and to carefully correlate those conditions with the Bidding Documents before submitting a Bid for the Project.

2.02 LAWS AND REGULATIONS – Bidders shall investigate and become familiar with all Laws and Regulation which affect the Project. All federal, state, and local Laws and Regulations having any impact on the Work to be performed and/or the Contract Price shall be considered and fully complied with by the Bidder in the preparation of its Bid.

2.03 OTHER INFORMATION – Other records, reports, or similar information regarding site investigations may be reviewed by Bidders, when available. Bidder may rely upon the general accuracy of the “technical data” contained in such information but not upon interpretations, opinions, and the like, nor upon the completeness thereof for the purpose of Bidding the Project. The availability of any such information shall not serve as replacement for the Bidders own investigation of the Project Site.

3. ADDENDA AND INTERPRETATION

3.01 GENERAL – All questions about the meaning or intent of the Bidding Documents are to be directed to the Engineer in writing. Questions received less than seven (7) calendar days before the date for opening of Bids may not be answered. Written questions may be delivered to the Engineer by hand, facsimile, mail, or other delivery system.

3.02 ADDENDA – Interpretations, clarifications, conditions, provisions, specifications, and the like considered necessary by the Engineer in response to Bidders’ questions will be issued by written Addenda mailed or otherwise delivered to all parties recorded by the Engineer as having received the Bidding Documents. Addenda may also be issued whenever deemed advisable by the Engineer. All Addenda shall become a binding part of the Bidding Documents. Each Bidder shall inquire about and satisfied itself as to the presence or absence of any Addenda issued for the Project before submission of a Bid. The Bidder accepts and agrees to comply with any and all interpretations, clarifications, conditions, provisions, specifications, and the like contained in any and all Addenda regardless of whether such Addenda were received by said Bidder before submission of its Bid.

3.03 ENGINEER’S INTERPRETATIONS – Only questions answered by formal written Addenda will be binding. Oral and other interpretations, clarifications, or approvals from the Engineer shall be non-binding and without legal effect.
4. BIDDER'S CONFORMANCE WITH THE REQUIREMENTS OF THE BIDDING DOCUMENTS

4.01 GENERAL – The submission of a Bid will constitute an incontrovertible representation by the Bidder to the following.
(a) The Bidder has complied with every requirement to investigate and/or examine the Project Site, the applicable Laws and Regulations, the Bidding Documents, and any other information as may be available or otherwise referenced in the Bidding Documents. Or, if the Bidder has not adequately performed such investigations and/or examinations, such Bidder agrees without exception to comply with all conditions, provisions, specifications, requirements, and the like set forth in the Bidding Documents.
(b) The Bidding Documents are sufficient to indicate and convey understanding of all terms, conditions, provisions, requirements, and the like as are necessary for performing the Work on the Project. The Bidder does not consider that any additional information, examinations, investigations, explorations, tests, studies, and/or data are necessary for the determination of its Bid.
(c) The Bid is without exception premised upon performing and furnishing the Work required by the Bidding Documents and applying the specific means, methods, techniques, sequences, and/or procedures of construction that are shown, indicated or expressly required by the Bidding Documents.

5. BID SECURITY

5.01 GENERAL – Each Bid shall be accompanied by a Bid Security in the form of a Bid Bond in an amount equal to ten percent (10%) of the Bidders maximum Bid price as a guarantee that such Bidder will enter into a Contract with the City in case such Bidder be Awarded a Contract. Said Bond shall be payable to the City, and conform to the requirements set forth in the Bidding Documents. In lieu thereof, a Bid may be accompanied by certified check, cashier’s check, or bank draft in an amount equal to five percent (5%) of the Bidders maximum Bid price. Said check shall be certified or issued by either a state or national bank and be payable to the City. Failure to submit a Bid Security with a Bid shall result in the rejection of said Bid.

6. UNIT PRICE WORK

6.01 GENERAL – All Work on this Project is to be classified as Unit Price Work as described elsewhere in the Bidding Documents. The final Contract Price shall be adjusted by Change Order or Written Amendment to reflect the actual units of each Contract Item completed on the Project.

7. SUBSTITUTE AND “OR-EQUAL” ITEMS

7.01 GENERAL – A Contract, if Awarded, will be based on the materials and equipment described in the Bidding Documents, including all Addenda. The Successful Bidder (or Contractor) shall not be relieved from complying with any requirements or obligations listed in the Bidding (or Contract) Documents because of Substitute and/or “Or-Equal” Items incorporated into the Bid price when such Substitute and/or “Or-Equal” Item was not specifically approved for use by the Engineer via an Addendum.

7.02 BIDDER'S REQUEST – The Bidder shall make written application to the Engineer for approval of all Substitute and/or “Or-Equal” Items a minimum of seven (7) calendar days before the date for opening of Bids. The only binding form of approval from the Engineer shall be an Addendum specifically approving such Substitute and/or “Or-Equal” Items for use on the Project. The Engineer shall have the authority to approve or reject Substitute and/or “Or-Equal” Items, or to choose not to consider Substitute and/or “Or-Equal” Items until after the Notice of Award has been issued. The procedures for submission of any such application by the Bidder and consideration by the Engineer are set forth in the Bidding Documents.

8. BIDDING PROCEDURES

8.01 GENERAL – The Bidder shall submit a Bid on the Bid Form provided with the Bidding Documents as supplied by the Engineer without any modification to the intent of the Bid Form. All blanks on the Bid Form must be completed in permanent ink or typed. Bids shall be regular in every respect and no modifications or special conditions shall be made, included, or attached to the Bid Form by the Bidder. All Bidding Documents shall be considered a binding part of the Bid whether attached thereto or not.
8.02 BID SCHEDULE – The Bidder shall fill all blanks on the Bid Schedule as hereinafter described unless otherwise described in the Bid Form. For Bid Items paid by the unit price Bid per unit, the Bidder shall enter its proposed unit prices for each item in the appropriate locations, and then multiply said unit prices by the estimated quantities listed, and enter the resultant item totals in the appropriate location. For Bid Items paid by the lump sum, the Bidder shall enter the entire lump sum Bid for each item in the respective blank designated for said items item total. All totals required on the Bid Schedule shall be calculated and the correct summations entered in the appropriate blanks.

8.03 ALTERNATIVE BIDS – No alternative Bids will be considered unless specifically requested on the Bid Form and/or indicated in the Bidding Documents. When a Bid Item on the Bid Form indicates a choice to be made by the Bidder, the Bidder shall indicate the choice in accordance with the requirements set forth in the Bidding Documents.

8.04 BIDDER’S SIGNATURE – The Bid must be signed in permanent ink by the Bidder as indicated hereafter.
(a) Bids by Corporations – The Bid must be signed in permanent ink by one or more officers of the corporation and the corporate seal must be affixed and attested by the secretary or an assistant secretary.
(b) Bids by Partnerships – The Bid must be signed in permanent ink by one or more members of the partnership.
(c) Bids by Joint Ventures – The Bid must be signed in permanent ink by one or more members or officers of each firm representing the joint venture.
(d) Bids by Individuals – The Bid must be signed in permanent ink by the individual.

8.05 SUBMISSION OF BIDS – Sealed Bids shall be filed in the Office of the City Finance Officer upon receipt thereof up until the time set forth in the Bidding Documents for the opening of Bids. Bids shall be submitted by hand, mail, or other delivery system acceptable to the City. Bidders shall not submit Bids by facsimile, and any Bids submitted by facsimile shall be rejected by the City. Bids received after the time set forth for the opening of Bids will be returned to the Bidder unopened. The Bidder shall assume all responsibility for delivery of Bids to the Finance Office. Each Bid shall be submitted in a sealed, opaque envelope clearly indicating that a Bid is enclosed. The Envelope shall be labeled with the Project title, the Project number, the name, address, and telephone number of the Bidder. When sent by mail or other delivery system, the properly labeled and sealed envelope containing the Bid shall be enclosed in a separate envelope with the notation “BID ENCLOSED” clearly marked on the face of the envelope and addressed as follows:

City of Watertown - Finance Department
23 2nd Street NE - P.O. Box 910
Watertown, SD 57201-0910

8.06 WITHDRAWAL OF BIDS – Any Bid may be withdrawn by the Bidder, provided the proper notice of the Bidders intent to withdraw the Bid is received by the Finance Officer before the time set forth for the opening of Bids. Proper notice of intent to withdraw a Bid shall be in writing and shall indicate the Project title, the Project number, the name, address, and telephone number of the Bidder, shall be signed by the Bidder, and shall be submitted by hand, facsimile, mail, or other delivery system. The Bidder shall assume all responsibility for the delivery of or failure to deliver such notice to the Finance Officer in an adequate manner. Upon receipt of Bidders intent to withdraw a Bid, the Finance Officer will return the Bid (including Bid Security) unopened to the Bidder.

8.07 MODIFICATION OF BIDS – Any Bid may be modified by proper notice from the Bidder to the Finance Officer, provided such notice is received by the Finance Officer before the time set forth for the opening of Bids. The modifications indicated in such notice shall not reveal the unit price of any Bid Item or the Bid total but rather shall reflect any additions or subtractions the Bidder intends to make to the unit price of any respective Bid Items and the Bid total. Proper notice of intent to modify a Bid shall be in writing and shall indicate the Project title, the Project number, the name, address, and telephone number of the Bidder, shall be signed by the Bidder, and shall be submitted by hand, facsimile, mail, or other delivery system. Bidders are cautioned that while modifications to Bids will be received as provided herein, such modifications, if not entirely explicit and unambiguous, may result in the modified Bid being deemed irregular and rejected. The Bidder shall assume all responsibility for the delivery of or failure to deliver such notice to the Finance Office in an acceptable manner. The Finance Officer will read aloud the Bid and the written modification to the Bid at the Bid opening and the written modification shall become a binding part of said Bid.
9. BID OPENING

9.01 GENERAL – The Invitation to Bid will state the date and time of the Bid opening. The Bids will be publicly opened and read aloud at or shortly after the designated time, within the Watertown City Hall, located at 23 2nd Street NE. The Finance Officer (or a duly authorized representative thereof) shall have the duty to open the Bids, and will determine when the specified time for opening of Bids has arrived and the exact location where Bids will be opened. Bidders and other persons interested in the proceedings may be present.

9.02 BID TABULATION – A tabulation of the Bids received and accepted will be prepared by the Engineer and made available to all interested parties. Discrepancies on the Bid Schedule between the item total and the multiplication of the estimated quantity by the unit price will be resolved in favor of the multiplication of the estimated quantity by the unit prices, and said item total will be corrected accordingly. Discrepancies between the indicated total or summation of any set of item totals and the correct summation thereof will be resolved in favor of the correct summation. Such corrected Bids shall remain binding on the Bidder in every way.

10. AWARD OF CONTRACT AND REJECTION OF BIDS

10.01 GENERAL – The City reserves the right to Award a Contract to the lowest Bidder, or to accept a Bid other than the lowest when deemed advisable by the City. Should a Contract be Awarded, it will be Awarded to lowest Bidder whose investigation by the Engineer indicates to the City that the Award will be in the best interests of the City and the Project. Acceptance of a Bid by the City shall only occur by action of the City Council. No other act of the City, the Engineer, or others shall constitute acceptance of a Bid by the City. If a Contract is Awarded, the Engineer will issue Notice of Award to the Successful Bidder.

10.02 ENGINEER’S INVESTIGATIONS – The Engineer may conduct such investigations as the City deems necessary to assist in the evaluation of any Bid. Such investigation(s) may be conducted to establish the responsibility, qualifications, and financial ability of any Bidder, proposed Subcontractor, proposed Supplier, other persons, and/or organizations proposed by the Bidder for any involvement with the Project.

10.03 EVALUATION OF BIDS – In evaluating Bids, the City may consider the qualifications and experience of the Bidders, whether or not the Bids comply with the Bidding Documents, the individual unit prices of Bid Items, and other data, as may be presented in the Bid Form or revealed by the Engineer’s investigation. The City may further consider the qualifications and experience of Subcontractors, Suppliers, other persons, and/or organizations proposed by the Bidder for involvement with the Project. In accordance with SDCL 5-19-3, preference shall be given to Bidders residing within the State of South Dakota over Bidders from other states that give preference to in-state Bidders.

10.04 FUEL TAX LICENSE – In accordance with SDCL 10-47B-69, the Successful Bidder shall possess (or obtain before Notice of Award is issued) a “highway contractor fuel tax license” whenever the anticipated Work will take place within a public highway, road, street, or the like.

10.05 REJECTION OF ALL BIDS – The City reserves the right to reject all Bids without explanation to Bidders. The City may or may not choose to schedule another Bid opening and solicit new Bids for the exact Project, or a modified Project.

10.06 IRREGULAR BIDS – The City reserves the right to reject any Bid due to the presence of any irregularities, or to waive irregularities in a Bid and Award a Contract to such Bidder when deemed advisable by the City. Bids will be considered irregular and may be rejected for the following reasons.
(a) The Bid contains unauthorized alterations, omissions, additions, conditions, or other irregularities or departures from the prescribed methods for completing and submitting Bids that may tend to make the Bid incomplete, indefinite, or ambiguous as to its meaning.
(b) The Bidder places any provisions or conditions reserving any right to accept or reject an Award, and/or to enter or not enter a Contract following an Award.
(c) The Bidder submits a unit price for a Bid Item in a deliberate attempt to take unfair advantage of any incorrect estimate of Bid Item quantities listed in the Bid Schedule.

10.07 COLLUSION – The Bidder shall not seek by collusion to obtain for itself or another Bidder any advantage over any other Bidder, or over the City. Any and/or all Bids may be rejected if the City has reason to believe that collusion exists among any or all of the Bidders. The City may Award a Contract to the lowest accepted Bidder, or choose to schedule
another Bid opening and solicit new Bids for the Project. Bidders participating in collusion shall not receive recognition as Bidders for future Projects of the City until any such participant shall have been reinstated as a qualified Bidder by the City Council.

10.08 DISQUALIFICATION OF BIDDERS – Bidder may be disqualified and its Bid rejected whenever evidence exists that such Bidder is not responsible as evidenced by its failure to meet any reasonable criteria established by the City. Each Bidder shall be prepared to submit, within Seven (7) calendar days after the opening of Bids and upon the Engineer’s request, detailed written evidence, such as financial reports, previous experience, present commitments, and other information as may be reasonably required for the Engineer’s investigation or the City’s evaluation. Failure by any Bidder, proposed Subcontractor, proposed Supplier, other persons, and/or organizations proposed by the Bidder for any involvement with the Project to cooperate with the Engineer’s Investigation may result in rejection of its Bid. Justification for disqualification of an irresponsible Bidder and rejection of its Bid include, but are not limited to the following reasons.

(a) Failure to prosecute Work diligently on other Projects whether for the City or other Owners.
(b) Failure to provide adequate superintendence on other Projects whether for the City or other Owners.
(c) Failure to meet Project completion dates on other Projects whether for the City or other Owners.
(d) Failure to cooperate with the Engineer on other Projects whether for the City or other Owners.

10.09 RELEASE OF BIDS – All Bids shall remain subject to acceptance by the City until the Successful Bidder has executed and delivered the Agreement, furnished the required Payment Bond, Performance Bond, and Certificate of Liability Insurance, and met all the requirements of the Notice of Award, whereupon all Bids and Bid Securities will be released. Regardless, all Bids and Bid Securities except for the Successful Bidders shall be released after thirty (30) calendar days have elapsed from the date of the Bid opening.

11. CONTRACT EXECUTION

11.01 GENERAL – The Contract will be executed in two (2) identical counterparts, with one counterpart being retained by the City and one being delivered to the Contractor. The Agreement provided by the Engineer shall be signed by the Successful Bidder and returned, together with the Payment Bond, Performance Bond, and Certificate of Liability Insurance within fourteen (14) calendar days after the Engineer issues Notice of Award to the Successful Bidder. A Contract shall not be considered as executed or effective until the City and the Successful Bidder have both signed the Agreement, and the Successful Bidder has provided an acceptable Payment Bond, Performance Bond, and Certificate of Liability Insurance to the City.

11.02 FAILURE TO EXECUTE CONTRACT – If the Successful Bidder fails to execute and deliver the Agreement, furnish the required Payment Bond, Performance Bond, and Certificate of Liability Insurance, and meet all the requirements of the Notice of Award within fourteen (14) calendar days after said Notice, the City may annul said Award and the Bid Security of that Bidder shall be forfeited to the City, not as a penalty, but in liquidation of damages sustained. The City may then issue a Notice of Award to the next lowest responsible Bidder or schedule another Bid opening and solicit new Bids.

12. CONTRACT SECURITY

12.01 GENERAL – Payment and Performance Bonds shall be required for this Project, and provided as set forth in the Bidding Documents.

13. PAYMENT

13.01 GENERAL – Payments will be made to the Contractor as detailed in the Bidding Documents. Monthly progress payments will be made based on an estimate of the value of the Work completed and approved by the Engineer including materials and equipment supplied for the Project less the stipulated retainage. Final payment will be made upon satisfactory completion of all Work and other requirements set forth by the Engineer in accordance with the Contract Documents.

14. EQUAL OPPORTUNITY

14.01 GENERAL – The City does not discriminate on the basis of race, color, national origin, sex, religion, age, or disability in employment or the provision of services. Bidders are required to ensure against discrimination on the Project because of race, color, national origin, sex, religion, age, or disability.
BID FORM

See Section 00410 – BID FORM
BID BOND

KNOW ALL BY THESE PRESENTS, that we, the undersigned Contractor as Principal and Surety, are hereby held and firmly bound unto the City of Watertown, South Dakota in the penal sum of Ten (10) Percent of the total amount bid as listed in the Bid Form, for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

The Condition of the above obligation is such that whereas the Contractor as Principal has submitted to said City a certain Bid, attached hereto and hereby made a part hereof to enter into a Contract for the Construction of the WASTEWATER TREATMENT FACILITIES ALKALINITY FEED ADDITION Project No. 1419.

NOW, THEREFORE, if said Bid shall be rejected by said City, or if said Bid shall be accepted by said City and the Contractor as Principal shall execute and deliver the Agreement in accordance with the Contract Documents, and shall furnish a Payment Bond, a Performance Bond, and Certificates of Insurance as provided in the Contract Documents, and shall in all other respects execute the Contract created by the acceptance of said Bid as set forth in the Notice of Award, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its Bid Bond shall be in no way impaired or affected by any extension of the time within which said City may accept such Bid, and said Surety does hereby waive notice of any such extension.

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

Signed, this the _______ day of _________________________, 2015.

PRINCIPAL: __________________________________________ (Type or Print)
AUTHORIZED SIGNATURE: __________________________________________ (Signature)
NAME: __________________________________________ (Type or Print)
TITLE: __________________________________________ (Type or Print)
SURETY: __________________________________________ (Type or Print)
AUTHORIZED SIGNATURE: __________________________________________ (Signature)
NAME: __________________________________________ (Type or Print)
TITLE: __________________________________________ (Type or Print)
ADDRESS: __________________________________________ (Type or Print)
______________________________ ________________________________ (Type or Print)
TELEPHONE NUMBER: __________________________________________ (Type or Print)
FACSIMILE NUMBER: __________________________________________ (Type or Print)

IMPORTANT: Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State of South Dakota.
NOTICE OF AWARD

DATE OF AWARD: ________________________________

CONTRACTOR: ______________________________________________

PROJECT: WASTEWATER TREATMENT FACILITIES ALKALINITY FEED ADDITION
Project No. 1419 for the City of Watertown, South Dakota

You are hereby notified that your Bid dated the _____ day of ___________________, 2015 for the above referenced Project has been accepted, and you have been awarded a Contract for Project No. 1419.

The Contract Price of your Contract shall be ________________________________, ($ ______________).

You are required by the Contract Documents to execute and deliver the Agreement and to furnish the Payment Bond, Performance Bond, and Certificates of Insurance and to in all other respects execute the Contract created by the acceptance of your Bid for the above referenced Project within fourteen (14) days from the date of this Notice of Award.

Should you fail to execute the Agreement, and to furnish the Payment Bond, Performance Bond, and Certificates of Insurance, and to in all other respects execute the Contract created by the acceptance of your Bid for the above referenced Project within the specified time, the City shall be entitled to consider all of your rights arising out the City’s acceptance of your Bid as abandoned and your Bid Security forfeited.

For The City of Watertown, South Dakota

_____________________________________________________ (Signature)
City Engineer

RECEIPT OF THIS NOTICE IS HEREBY ACKNOWLEDGED.

FOR: ___________________________________________________ (Type or Print)

AUTHORIZED SIGNATURE: ___________________________________________ (Signature)

NAME: ______________________________________________________ (Type or Print)

TITLE: ________________________________________________________ (Type or Print)

Complete and return to the Office of the City Engineer immediately.

City Engineer
23 Second Street NE
P. O. Box 910
Watertown, South Dakota 57201-0910
AGREEMENT

PROJECT: WASTEWATER TREATMENT FACILITIES ALKALINITY FEED ADDITION Project No. 1419

CONTRACTOR: _______________________________________________________

THIS AGREEMENT, made this ____ day of____________, 2015, by and between the City of Watertown, South Dakota hereinafter referred to as the City, and the Contractor as heretofore named.

WITNESSETH that the City and the Contractor, for the considerations hereinafter stipulated, agree as follows:

ARTICLE 1 – SCOPE OF WORK

1.01 – The Contractor shall perform all Work associated with the construction of this Project as set forth in the Contract Documents. The scope of Work shall include all labor, materials, equipment, tools, services, and the like required by the Contract Documents or otherwise necessary for the completion of the Project. The Contract Items shall include those Bid Items indicated on the Notice of Award with the estimated quantities and unit prices listed in the accepted Bid Schedule.

ARTICLE 2 – CONTRACT TIMES

2.01 Substantial Completion Date – The Work to be performed on this Project shall be Substantially Complete in accordance with GC14.04 by the 30th Day of November, 2015.

2.02 Final Completion Date – The Work to be performed on this Project shall be fully complete and otherwise ready for final payment in accordance with GC14.07B before thirty (30) Calendar Days have expired from the date the Engineer determines the Work to be Substantially Complete.

2.03 Changes in Contract Times – Changes in the Contract Times shall only occur as provided in GC12.02.

2.04 Liquidated Damages – The Engineer shall deduct liquidated damages from payments due to the Contractor for failure to complete the Work on or before the completion dates in accordance with SC14.12.

ARTICLE 3 – CONTRACT PRICE

3.01 – The City shall pay the Contractor for completion of the Work to be performed on this Project in accordance with the Contract Documents, subject to additions and deductions as provided for in the Contract Documents, in current funds as follows: _______________________________ Dollars ($__________).  

3.02 – Unit Price Work – All Work to be performed on this Project shall be classified as Unit Price Work as described in GC11.03. The final Contract Price shall be adjusted by Change Order or Written Amendment (as provided in GC12.01) to reflect the actual units of each Contract Item completed on the Project.

3.03 - Changes in Contract Price – Changes in the Contract Price shall only occur as provided in GC12.01.

3.04 Liquidated Damages – The Contractor acknowledges and hereby accepts that the Engineer shall deduct liquidated damages from payments due to the Contractor for failure to complete the Work on or before the completion dates in accordance with SC14.12.

ARTICLE 4 – PAYMENT PROCEDURES

4.01 – The Contractor shall make Applications for Payment, and the Engineer shall process such Applications for Payment, and the City shall make payments resulting therefrom in accordance with GC14.02 for progress payments, and in accordance with GC14.07 for final payment.
ARTICLE 5 – CONTRACT DOCUMENTS

5.01 – The Contract Documents comprise the entire agreement between the City and the Contractor concerning the Work to be performed on this Project. The Contract Documents include this Agreement, the Bid Form, all Addenda identified on the Bid Form, the Payment Bond, the Performance Bond, the Notice to Proceed, the Notice of Substantial Completion, the General Conditions, the Supplementary Conditions, the Special Provisions, the General Requirements, and all the various Specifications and Drawings identified in the Project Manual’s Table of Contents, as well as all Written Amendments, Change Orders and the like, as may be executed after the effective date of this Agreement.

5.02 Additional Contract Documents – The following documents shall be included as Contract Documents for this Project. (If none so state.) ____________________________________________

5.03 Changes in Contract Documents – Changes in the Contract Documents shall only occur as provided in GC3.04.

ARTICLE 6 – CONTRACTOR’S UNDERSTANDING

6.01 – The Contractor stipulates and agrees that it has (i) thoroughly examined and understands all the Contract Documents and other related data, (ii) investigated and become familiar with the existing conditions present at the Project Site, (iii) investigated and become familiar with all Laws and Regulation which affect the Work to be performed on this Project, AND (iv) fully correlated the information from (i), (ii), and (iii). Or, if the Contractor has not adequately performed such investigations and/or examinations that the Contractor agrees without exception to comply with all conditions, provisions, specifications, requirements, and the like set forth in the Contract Documents.

6.02 – The Contractor stipulates and agrees that the Contract Documents are generally sufficient to indicate and convey understanding of all terms, conditions, provisions, specifications, requirements, and the like as necessary to perform the Work on this Project. The Contractor does not consider that any additional information, examinations, investigations, explorations, tests, studies, and/or data are necessary to perform the Work on this Project.

IN WITNESS WHEREOF, the City of Watertown, South Dakota, a municipal corporation, by the City Council having duly approved this Agreement, has caused this Agreement to be executed (in two counterparts, each one of which shall be deemed an original) in its behalf by its Mayor, thereunto duly authorized, and attested thereto by its Finance Officer.

By:  ____________________________________________________ (Signature)

Mayor Steve Thorson

(SEAL)

ATTEST: ____________________________________________________ (Signature)

Rochelle Ebbers, CPA
Finance Officer

IN WITNESS WHEREOF, the Contractor, ______________________________________, has caused this Agreement to be executed (in two counterparts, each one of which shall be deemed an original) in its behalf.

AUTHORIZED SIGNATURE: _____________________________________________ (Signature)

NAME: _____________________________________________ (Type or Print)

TITLE: _____________________________________________ (Type or Print)

(SEAL, if required)

ATTESTING SIGNATURE: _____________________________________________ (Type or Print)

NAME: _____________________________________________ (Type or Print)

TITLE: _____________________________________________ (Signature)
LIST OF SUBCONTRACTORS

Date:___________, 2015

To:  City of Watertown
    Watertown, South Dakota

Gentlemen:

The following subcontractors and sub-subcontractors will work in the construction of:

WASTEWATER TREATMENT FACILITIES ALKALINITY FEED ADDITION
Project No. 1419
Watertown, South Dakota

“General Contractor” is inserted under all headings for which no subcontract will be let. A check in the proper column indicates whether the subcontract covers material only or includes some installation also. I/We agree not to change subcontractors or sub-subcontractors listed below without written approval of the City of Watertown, and the City of Watertown reserves the right to reject any or all of the subcontractors and sub-subcontractors listed hereafter and nominate another bidding subcontractor or sub-subcontractor in his or their place. If the City of Watertown elects another subcontractor or sub-subcontractor, the difference in cost will be adjusted to my/their proposal.

The Contractor agrees that he is as fully responsible to the City of Watertown for the acts and omissions of his subcontractors and of persons either directly or indirectly employed by them, as he is for the acts and omissions of personnel directly employed by him.

Nothing contained in the Contract documents shall create any contractual relation between any subcontractor and the City of Watertown.

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PAYMENT BOND

KNOW ALL BY THESE PRESENTS, that we the undersigned Contractor as Principal and Surety are held and firmly bound unto the City of Watertown, in the penal sum of

__________________________________________________________________________ Dollars ($                       ) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Contractor as Principal entered into a certain Agreement with the City, dated the _____day of____________, 2015, which is hereby made a part hereof, for the construction of the WASTEWATER TREATMENT FACILITIES ALKALINITY FEED ADDITION Project No. 1419.

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

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

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

And the further condition of this Bond is that in the event the Contractor as Principal shall fail to pay all just claims and demands on the part any employee, persons, firms, or corporations for labor and materials furnished for or used in connection with the prosecution of the Work under said Contract, or pay all taxes which may accrue to the State of South Dakota under the provisions of the “Use Tax Act of 1939 and the Excise Tax on Realty Improvements under SDCL 10-46A”, and Sections 5-21-3 and 5-21-4 of the South Dakota Complied Laws of 1967, as amended, then this Bond and the Surety thereon shall be responsible to such persons, firms or corporations, and to the City for the full payment of the full value of such labor and materials so furnished including the payment of all South Dakota Use Tax and the Excise Tax on Realty Improvements.

IN WITNESS WHEREOF, the Contractor as Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, in two counterparts, each one of which shall be deemed an original.

NOTES: The date of the Bond must not be prior to date of the Agreement.

If the Contractor is a partnership, all partners should execute the Bond.
IMPORTANT: Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State of South Dakota.
SIGNED THIS THE _____ DAY OF ____________________, 2015.

PRINCIPAL: _____________________________________________ (Type or Print)

AUTHORIZED SIGNATURE: ___________________________________________ (Signature)

NAME: _____________________________________________ (Type or Print)

(SEAL, if required)

TITLE: _____________________________________________ (Type or Print)

ATTEST BY SECRETARY: ___________________________________________ (Signature)

NAME: _____________________________________________ (Type or Print)

WITNESS AS TO PRINCIPAL: ___________________________________________ (Signature)

NAME: _____________________________________________ (Type or Print)

SURETY: _____________________________________________ (Type or Print)

AUTHORIZED SIGNATURE: ___________________________________________ (Signature)

NAME: _____________________________________________ (Type or Print)

(SEAL, if required)

TITLE: _____________________________________________ (Type or Print)

ATTEST BY SECRETARY: ___________________________________________ (Signature)

NAME: _____________________________________________ (Type or Print)

WITNESS AS TO SURETY: ___________________________________________ (Signature)

NAME: _____________________________________________ (Type or Print)

COUNTERSIGNED BY: ___________________________________________ (Signature)

NAME: _____________________________________________ (Type or Print)

TITLE: South Dakota Resident Agent for Surety

SURETY ADDRESS: _____________________________________________ (Type or Print)

____________________________________________________________________ (Type or Print)

TELEPHONE NUMBER: _____________________________________________ (Type or Print)

FACSIMILE NUMBER: _____________________________________________ (Type or Print)
PERFORMANCE BOND

KNOW ALL BY THESE PRESENTS, that we the undersigned Contractor as Principal and Surety are held and firmly bound unto the City of Watertown, in the penal sum of ___________________________ Dollars ($_______) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Contractor as Principal entered into a certain Agreement with the City, dated the ____ day of____________, 2015, which is hereby made a part hereof, for the construction of the WASTEWATER TREATMENT FACILITIES ALKALINITY FEED ADDITION Project No. 1419.

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

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

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

IN WITNESS WHEREOF, the Contractor as Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, in two counterparts, each one of which shall be deemed an original.

NOTES: The date of the Bond must not be prior to date of the Agreement.
If the Contractor is a partnership, all partners should execute the Bond.
IMPORTANT: Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State of South Dakota.

SIGNED THIS THE ______ DAY OF ____________________, 2015.

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NOTICE TO PROCEED

DATE TO PROCEED: _______________________

CONTRACTOR: _____________________________________________

PROJECT: WASTEWATER TREATMENT FACILITIES ALKALINITY FEED ADDITION
Project No. 1419 for the City of Watertown, South Dakota

In accordance with the Agreement dated the _____ day of____________, 2015, you are hereby notified to commence Work
on the above referenced Project. The Work to be performed under this Contract shall be Substantially Completed by the 30th
Day of November, 2015.

For The City of Watertown, South Dakota

_____________________________________________________ (Signature)
City Engineer

RECEIPT OF THIS NOTICE IS HEREBY ACKNOWLEDGED.

FOR: ___________________________________________________ (Type or Print)

AUTHORIZED SIGNATURE: __________________________________________ (Signature)

NAME: _______________________________________________________ (Type or Print)

TITLE: _________________________________________________________ (Type or Print)

Complete and return to the Office of the City Engineer immediately.

City Engineer
23 Second Street NE
P.O. Box 910
Watertown, South Dakota 57201-0910

Chapter 1: Contract Documents
Page 19
NOTICE OF SUBSTANTIAL COMPLETION

DATE OF SUBSTANTIAL COMPLETION: _________________ _____, 2015

CONTRACTOR: ________________________________________________________________

PROJECT: WASTEWATER TREATMENT FACILITIES ALKALINITY FEED ADDITION
Project No. 1419 for the City of Watertown, South Dakota

In accordance with the Agreement dated the ______ day of ______________________, 2015, you are hereby notified that the Work on the above referenced Project is Substantially Completed. All remaining Work to be performed under this Contract shall be finally completed and otherwise ready for final payment before thirty (30) days have expired. In accordance with GC17.02,

the final completion date shall be the ______ day of _________________________, 2015.

For The City of Watertown, South Dakota

_____________________________________________________ (Signature)
City Engineer

RECEIPT OF THIS NOTICE IS HEREBY ACKNOWLEDGED.

FOR: ___________________________________________________ (Type or Print)

AUTHORIZED SIGNATURE: __________________________________________________ (Signature)

NAME: ___________________________________________________ (Type or Print)

TITLE: ___________________________________________________ (Type or Print)

Complete and return to the Office of the City Engineer immediately.  

City Engineer  
23 Second Street NE  
P.O. Box 910  
Watertown, South Dakota 57201-0910
STANDARD
GENERAL CONDITIONS
OF THE
CONSTRUCTION CONTRACT

Prepared by
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By

AMERICAN CONSULTING ENGINEERS COUNCIL

PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE

a practice division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

AMERICAN CONSULTING ENGINEERS COUNCIL

AMERICAN SOCIETY OF CIVIL ENGINEERS

This document has been approved and endorsed by
The Associated General Contractors of America
Construction Specifications Institute

These General Conditions have been prepared for use with the Owner-Contractor Agreements (No. 1910-8-A-1 or 1910-8-A-2) (1996 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the EJCDC User’s Guide (No. 1910-50). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (No. 1910-17) (1996 Edition).


*INDICATES A PARAGRAPH HAS BEEN MODIFIED OR ADDED BY THE SUPPLEMENTARY CONDITIONS. March 8, 2010
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Chapter 2: General Conditions

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GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

* A. Wherever used in the Contract Documents and printed with initial or all capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof.

1. Addenda--Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the Contract Documents.

2. Agreement--The written instrument which is evidence of the agreement between OWNER and CONTRACTOR covering the Work.

3. Application for Payment--The form acceptable to ENGINEER which is to be used by CONTRACTOR during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. Asbestos--Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. Bid--The offer or proposal of a bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. Bidding Documents--The Bidding Requirements and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

7. Bidding Requirements--The Advertisement or Invitation to Bid, Instructions to Bidders, Bid security form, if any, and the Bid form with any supplements.

8. Bonds--Performance and payment bonds and other instruments of security.

9. Change Order--A document recommended by ENGINEER which is signed by CONTRACTOR and OWNER and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

10. Claim--A demand or assertion by OWNER or CONTRACTOR seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. Contract--The entire and integrated written agreement between the OWNER and CONTRACTOR concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. Contract Documents--The Contract Documents establish the rights and obligations of the parties and include the Agreement, Addenda (which pertain to the Contract Documents), CONTRACTOR’s Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Notice to Proceed, the Bonds, these General Conditions, the Supplementary Conditions, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all Written Amendments, Change Orders, Work Change Directives, Field Orders, and ENGINEER’s written interpretations and clarifications issued on or after the Effective Date of the Agreement. Approved Shop Drawings and the reports and drawings of subsurface and physical conditions are not Contract Documents. Only printed or hard copies of the items listed in this paragraph are Contract Documents. Files in electronic media format of text, data, graphics, and the like that may be furnished by OWNER to CONTRACTOR are not Contract Documents.

13. Contract Price--The moneys payable by OWNER to CONTRACTOR for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of paragraph 11.03 in the case of Unit Price Work).

14. Contract Times--The number of days or the dates stated in the Agreement to: (i) achieve Substantial Completion; and (ii) complete the Work so that it is ready for final payment as evidenced by ENGINEER’s written recommendation of final payment.

15. CONTRACTOR--The individual or entity with whom OWNER has entered into the Agreement.

17. **Drawings**--That part of the Contract Documents prepared or approved by ENGINEER which graphically shows the scope, extent, and character of the Work to be performed by CONTRACTOR. Shop Drawings and other CONTRACTOR submittals are not Drawings as so defined.

18. **Effective Date of the Agreement**--The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

19. **ENGINEER**--The individual or entity named as such in the Agreement.

20. **ENGINEER’s Consultant**--An individual or entity having a contract with ENGINEER to furnish services as ENGINEER’s independent professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions.

21. **Field Order**--A written order issued by ENGINEER which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

22. **General Requirements**--Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.

23. **Hazardous Environmental Condition**--The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.

24. **Hazardous Waste**--The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

25. **Laws and Regulations; Laws or Regulations**--Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. **Liens**--Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

27. **Milestone**--A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

28. **Notice of Award**--The written notice by OWNER to the apparent successful bidder stating that upon timely compliance by the apparent successful bidder with the conditions precedent listed therein, OWNER will sign and deliver the Agreement.

29. **Notice to Proceed**--A written notice given by OWNER to CONTRACTOR fixing the date on which the Contract Times will commence to run and on which CONTRACTOR shall start to perform the Work under the Contract Documents.

30. **OWNER**--The individual, entity, public body, or authority with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be performed.

31. **Partial Utilization**--Use by OWNER of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.

32. **PCBs**--Polychlorinated biphenyls.

33. **Petroleum**--Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

34. **Project**--The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part as may be indicated elsewhere in the Contract Documents.

35. **Project Manual**--The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

36. **Radioactive Material**--Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

37. **Resident Project Representative**--The authorized representative of ENGINEER who may be assigned to the Site or any part thereof.
38. **Samples**—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

39. **Shop Drawings**—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR to illustrate some portion of the Work.

40. **Site**—Lands or areas indicated in the Contract Documents as being furnished by OWNER upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by OWNER which are designated for the use of CONTRACTOR.

41. **Specifications**—That part of the Contract Documents consisting of written technical descriptions of materials, equipment, systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.

42. **Subcontractor**—An individual or entity having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the Site.

43. **Substantial Completion**—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of ENGINEER, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.

44. **Supplementary Conditions**—That part of the Contract Documents which amends or supplements these General Conditions.

45. **Supplier**—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with CONTRACTOR or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by CONTRACTOR or any Subcontractor.

46. **Underground Facilities**—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

47. **Unit Price Work**—Work to be paid for on the basis of unit prices.

48. **Work**—The entire completed construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

49. **Work Change Directive**—A written statement to CONTRACTOR issued on or after the Effective Date of the Agreement and signed by OWNER and recommended by ENGINEER ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

50. **Written Amendment**—A written statement modifying the Contract Documents, signed by OWNER and CONTRACTOR on or after the Effective Date of the Agreement and normally dealing with the nonengineering or nontechnical rather than strictly construction-related aspects of the Contract Documents.

* 51. through 76.

1.02 **Terminology**

A. **Intent of Certain Terms or Adjectives**

1. Whenever in the Contract Documents the terms “as allowed,” “as approved,” or terms of like effect or import are used, or the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of ENGINEER as to the Work, it is intended that such action or determination will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific
statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to ENGINEER any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.10 or any other provision of the Contract Documents.

B. Day

1. The word “day” shall constitute a calendar day of 24 hours measured from midnight to the next midnight.

C. Defective

1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it does not conform to the Contract Documents or does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents, or has been damaged prior to ENGINEER’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by OWNER at Substantial Completion in accordance with paragraph 14.04 or 14.05).

D. Furnish, Install, Perform, Provide

1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of CONTRACTOR, “provide” is implied.

E. Unless stated otherwise in the Contract Documents, words or phrases which have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 - PRELIMINARY MATTERS

2.01 Delivery of Bonds

A. When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds as CONTRACTOR may be required to furnish.

2.02 Copies of Documents

A. OWNER shall furnish to CONTRACTOR up to ten copies of the Contract Documents. Additional copies will be furnished upon request at the cost of reproduction.

2.03 Commencement of Contract Times; Notice to Proceed

* A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 Starting the Work

A. CONTRACTOR shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 Before Starting Construction

A. CONTRACTOR’s Review of Contract Documents: Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error, ambiguity, or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from ENGINEER.
before proceeding with any Work affected thereby; however, CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless CONTRACTOR knew or reasonably should have known thereof.

* B. Preliminary Schedules: Within ten days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), CONTRACTOR shall submit to ENGINEER for its timely review:

1. a preliminary progress schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. a preliminary schedule of Shop Drawing and Sample submittals which will list each required submittal and the times for submitting, reviewing, and processing such submittal; and

3. a preliminary schedule of values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

C. Evidence of Insurance: Before any Work at the Site is started, CONTRACTOR and OWNER shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which CONTRACTOR and OWNER respectively are required to purchase and maintain in accordance with Article 5.

2.06 Preconstruction Conference

* A. Within 20 days after the Contract Times start to run, but before any Work at the Site is started, a conference attended by CONTRACTOR, ENGINEER, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in paragraph 2.05.B, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2.07 Initial Acceptance of Schedules

* A. Unless otherwise provided in the Contract Documents, at least ten days before submission of the first Application for Payment a conference attended by CONTRACTOR, ENGINEER, and others as appropriate will be held to review for acceptability to ENGINEER as provided below the schedules submitted in accordance with paragraph 2.05.B. CONTRACTOR shall have an additional ten days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to CONTRACTOR until acceptable schedules are submitted to ENGINEER.

1. The progress schedule will be acceptable to ENGINEER if it provides an orderly progression of the Work to completion within any specified Milestones and the Contract Times. Such acceptance will not impose on ENGINEER responsibility for the progress schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve CONTRACTOR from CONTRACTOR’s full responsibility therefor.

2. CONTRACTOR’s schedule of Shop Drawing and Sample submittals will be acceptable to ENGINEER if it provides a workable arrangement for reviewing and processing the required submittals.

3. CONTRACTOR’s schedule of values will be acceptable to ENGINEER as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 Intent

A. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to OWNER.
C. Clarifications and interpretations of the Contract Documents shall be issued by ENGINEER as provided in Article 9.

* D.

3.02 Reference Standards

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of OWNER, CONTRACTOR, or ENGINEER, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall any such provision or instruction be effective to assign to OWNER, ENGINEER, or any of ENGINEER’s Consultants, agents, or employees any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 Reporting and Resolving Discrepancies

A. Reporting Discrepancies

1. If, during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, CONTRACTOR shall report it to ENGINEER in writing at once. CONTRACTOR shall not proceed with the Work affected thereby (except in an emergency as required by paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in paragraph 3.04; provided, however, that CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any such conflict, error, ambiguity, or discrepancy unless CONTRACTOR knew or reasonably should have known thereof.

B. Resolving Discrepancies

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

   a. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

   b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 Amending and Supplementing Contract Documents

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways: (i) a Written Amendment; (ii) a Change Order; or (iii) a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways: (i) a Field Order; (ii) ENGINEER’s approval of a Shop Drawing or Sample; or (iii) ENGINEER’s written interpretation or clarification.

3.05 Reuse of Documents

A. CONTRACTOR and any Subcontractor or Supplier or other individual or entity performing or furnishing any of the Work under a direct or indirect contract with OWNER: (i) shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER or ENGINEER’s Consultant, including electronic media editions; and (ii) shall not reuse any of such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without...
written consent of OWNER and ENGINEER and specific written verification or adoption by ENGINEER. This prohibition will survive final payment, completion, and acceptance of the Work, or termination or completion of the Contract. Nothing herein shall preclude CONTRACTOR from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

4.01 Availability of Lands

A. OWNER shall furnish the Site. OWNER shall notify CONTRACTOR of any encumbrances or restrictions not of general application but specifically related to use of the Site with which CONTRACTOR must comply in performing the Work. OWNER will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If CONTRACTOR and OWNER are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in OWNER's furnishing the Site, CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

B. Upon reasonable written request, OWNER shall furnish CONTRACTOR with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and OWNER’s interest therein as necessary for giving notice of or filing a mechanic’s or construction lien against such lands in accordance with applicable Laws and Regulations.

C. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 Subsurface and Physical Conditions

* A. Reports and Drawings: The Supplementary Conditions identify:

1. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that ENGINEER has used in preparing the Contract Documents; and

2. those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that ENGINEER has used in preparing the Contract Documents.

* B. Limited Reliance by CONTRACTOR on Technical Data Authorized: CONTRACTOR may rely upon the general accuracy of the “technical data” contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such “technical data” is identified in the Supplementary Conditions. Except for such reliance on such “technical data,” CONTRACTOR may not rely upon or make any Claim against OWNER, ENGINEER, or any of ENGINEER's Consultants with respect to:

1. the completeness of such reports and drawings for CONTRACTOR’s purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any CONTRACTOR interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 Differing Subsurface or Physical Conditions

A. Notice: If CONTRACTOR believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed either:

1. is of such a nature as to establish that any “technical data” on which CONTRACTOR is entitled to rely as provided in paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing the subsurface or...
physical conditions or performing any Work in connection therewith (except in an emergency as required by paragraph 6.16.A), notify OWNER and ENGINEER in writing about such condition. CONTRACTOR shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. ENGINEER’s Review: After receipt of written notice as required by paragraph 4.03.A, ENGINEER will promptly review the pertinent condition, determine the necessity of OWNER's obtaining additional exploration or tests with respect thereto, and advise OWNER in writing (with a copy to CONTRACTOR) of ENGINEER’s findings and conclusions.

C. Possible Price and Times Adjustments

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in CONTRACTOR’s cost of, or time required for, performance of the Work; subject, however, to the following:

   a. such condition must meet any one or more of the categories described in paragraph 4.03.A; and

   b. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of paragraphs 9.08 and 11.03.

2. CONTRACTOR shall not be entitled to any adjustment in the Contract Price or Contract Times if:

   a. CONTRACTOR knew of the existence of such conditions at the time CONTRACTOR made a final commitment to OWNER in respect of Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

   b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for CONTRACTOR prior to CONTRACTOR's making such final commitment; or

   c. CONTRACTOR failed to give the written notice within the time and as required by paragraph 4.03.A.

3. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in paragraph 10.05. However, OWNER, ENGINEER, and ENGINEER’s Consultants shall not be liable to CONTRACTOR for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by CONTRACTOR on or in connection with any other project or anticipated project.

4.04 Underground Facilities

A. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to OWNER or ENGINEER by the owners of such Underground Facilities, including OWNER, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. OWNER and ENGINEER shall not be responsible for the accuracy or completeness of any such information or data; and

2. the cost of all of the following will be included in the Contract Price, and CONTRACTOR shall have full responsibility for:

   a. reviewing and checking all such information and data,

   b. locating all Underground Facilities shown or indicated in the Contract Documents,

   c. coordination of the Work with the owners of such Underground Facilities, including OWNER, during construction, and

   d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. Not Shown or Indicated
1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to OWNER and ENGINEER. ENGINEER will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility.

2. If ENGINEER concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price of Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that CONTRACTOR did not know of and could not reasonably have been expected to be aware of or to have anticipated. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, OWNER or CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

4.05 Reference Points

A. OWNER shall provide engineering surveys to establish reference points for construction which in ENGINEER’s judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of OWNER. CONTRACTOR shall report to ENGINEER whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 Hazardous Environmental Condition at Site

* A. Reports and Drawings: Reference is made to the Supplementary Conditions for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the ENGINEER in the preparation of the Contract Documents.

* B. Limited Reliance by CONTRACTOR on Technical Data Authorized: CONTRACTOR may rely upon the general accuracy of the “technical data” contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such “technical data” is identified in the Supplementary Conditions. Except for such reliance on such “technical data,” CONTRACTOR may not rely upon or make any Claim against OWNER, ENGINEER or any of ENGINEER’s Consultants with respect to:

1. the completeness of such reports and drawings for CONTRACTOR’s purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any CONTRACTOR interpretation of or conclusion drawn from any “technical data” or any such other data, interpretations, opinions or information.

C. CONTRACTOR shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. CONTRACTOR shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by CONTRACTOR, Subcontractors, Suppliers, or anyone else for whom CONTRACTOR is responsible.

D. If CONTRACTOR encounters a Hazardous Environmental Condition or if CONTRACTOR or anyone for whom CONTRACTOR is responsible creates a Hazardous Environmental Condition, CONTRACTOR shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such
condition and in any area affected thereby (except in an emergency as required by paragraph 6.16); and (iii) notify OWNER and ENGINEER (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

E. CONTRACTOR shall not be required to resume Work in connection with such condition or in any affected area until after OWNER has obtained any required permits related thereto and delivered to CONTRACTOR written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If OWNER and CONTRACTOR cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by CONTRACTOR, either party may make a Claim therefor as provided in paragraph 10.05.

F. If after receipt of such written notice CONTRACTOR does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then OWNER may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If OWNER and CONTRACTOR cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in paragraph 10.05. OWNER may have such deleted portion of the Work performed by OWNER’s own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, OWNER shall indemnify and hold harmless CONTRACTOR, Subcontractors, ENGINEER, ENGINEER’s Consultants and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.E shall obligate OWNER to indemnify any individual or entity from and against the consequences of that individual’s or entity’s own negligence.

H. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER’s Consultants, and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.F shall obligate CONTRACTOR to indemnify any individual or entity from and against the consequences of that individual’s or entity’s own negligence.

I. The provisions of paragraphs 4.02, 4.03, and 4.04 are not intended to apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 - BONDS AND INSURANCE

5.01 Performance, Payment, and Other Bonds

* A. CONTRACTOR shall furnish performance and payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all CONTRACTOR’s obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, except as provided otherwise by Laws or Regulations or by the Contract Documents. CONTRACTOR shall also furnish such other Bonds as are required by the Contract Documents.

B. All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All Bonds signed by an agent must be accompanied by a certified copy of such agent’s authority to act.
C. If the surety on any Bond furnished by CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 5.01.B, CONTRACTOR shall within 20 days thereafter substitute another Bond and surety, both of which shall comply with the requirements of paragraphs 5.01.B and 5.02.

5.02 Licensed Sureties and Insurers

A. All Bonds and insurance required by the Contract Documents to be purchased and maintained by OWNER or CONTRACTOR shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue Bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 Certificates of Insurance

A. CONTRACTOR shall deliver to OWNER, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by OWNER or any other additional insured) which CONTRACTOR is required to purchase and maintain. OWNER shall deliver to CONTRACTOR, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by CONTRACTOR or any other additional insured) which OWNER is required to purchase and maintain.

5.04 CONTRACTOR’s Liability Insurance

A. CONTRACTOR shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from CONTRACTOR’s performance of the Work and CONTRACTOR’s other obligations under the Contract Documents, whether it is to be performed by CONTRACTOR, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers’ compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR’s employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR’s employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (ii) by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance so required by this paragraph 5.04 to be purchased and maintained shall:

1. with respect to insurance required by paragraphs 5.04.A.3 through 5.04.A.6 inclusive, include as additional insureds (subject to any customary exclusion in respect of professional liability) OWNER, ENGINEER, ENGINEER’s Consultants, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

a. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include completed operations insurance;
4. include contractual liability insurance covering CONTRACTOR’s indemnity obligations under paragraphs 6.07, 6.11, and 6.20;

* 5. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least thirty days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the CONTRACTOR pursuant to paragraph 5.03 will so provide);

6. remain in effect at least until final payment and at all times thereafter when CONTRACTOR may be correcting, removing, or replacing defective Work in accordance with paragraph 13.07; and

* 7. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment (and CONTRACTOR shall furnish OWNER and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to OWNER and any such additional insured of continuation of such insurance at final payment and one year thereafter).

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5.05 OWNER’s Liability Insurance

A. In addition to the insurance required to be provided by CONTRACTOR under paragraph 5.04, OWNER, at OWNER’s option, may purchase and maintain at OWNER’s expense OWNER’s own liability insurance as will protect OWNER against claims which may arise from operations under the Contract Documents.

5.06 Property Insurance

* A. Unless otherwise provided in the Supplementary Conditions, OWNER shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

* 1. include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER’s Consultants, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an additional insured;

* 2. be written on a Builder’s Risk “all-risk” or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, false work, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;

* 3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

* 4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by OWNER prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by ENGINEER;

* 5. allow for partial utilization of the Work by OWNER;

* 6. include testing and startup; and

* 7. be maintained in effect until final payment is made unless otherwise agreed to in writing by OWNER, CONTRACTOR, and ENGINEER with 30 days written notice to each other additional
insured to whom a certificate of insurance has been issued.

B. OWNER shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER’s Consultants, and any other individuals or entities identified in the Supplementary Conditions, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.

* C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with paragraph 5.07.

D. OWNER shall not be responsible for purchasing and maintaining any property insurance specified in this paragraph 5.06 to protect the interests of CONTRACTOR, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by CONTRACTOR, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser’s own expense.

E. If CONTRACTOR requests in writing that other special insurance be included in the property insurance policies provided under paragraph 5.06, OWNER shall, if possible, include such insurance, and the cost thereof will be charged to CONTRACTOR by appropriate Change Order or Written Amendment. Prior to commencement of the Work at the Site, OWNER shall in writing advise CONTRACTOR whether or not such other insurance has been procured by OWNER.

5.07 Waiver of Rights

* A. OWNER and CONTRACTOR intend that all policies purchased in accordance with paragraph 5.06 will protect OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER’s Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder. OWNER and CONTRACTOR waive all rights against each other and their respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors, ENGINEER, ENGINEER’s Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by OWNER as trustee or otherwise payable under any policy so issued.

B. OWNER waives all rights against CONTRACTOR, Subcontractors, ENGINEER, ENGINEER’s Consultants, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to OWNER’s property or the Work caused by, arising out of, or resulting from fire or other peril whether or not insured by OWNER; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by OWNER during partial utilization pursuant to paragraph 14.05, after Substantial Completion pursuant to paragraph 14.04, or after final payment pursuant to paragraph 14.07.

C. Any insurance policy maintained by OWNER covering any loss, damage or consequential loss referred to in paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against CONTRACTOR, Subcontractors,
5.08 Receipt and Application of Insurance Proceeds

A. Any insured loss under the policies of insurance required by paragraph 5.06 will be adjusted with OWNER and made payable to OWNER as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.08.B. OWNER shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.

B. OWNER as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to OWNER’s exercise of this power. If such objection be made, OWNER as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, OWNER as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, OWNER as fiduciary shall give bond for the proper performance of such duties.

5.09 Acceptance of Bonds and Insurance; Option to Replace

A. If either OWNER or CONTRACTOR has any objection to the coverage afforded by or other provisions of the Bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by paragraph 2.05.C. OWNER and CONTRACTOR shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the Bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent Bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 Partial Utilization, Acknowledgment of Property Insurer

A. If OWNER finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

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ARTICLE 6 - CONTRACTOR’S RESPONSIBILITIES

6.01 Supervision and Superintendence

A. CONTRACTOR shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction, but CONTRACTOR shall not be responsible for the negligence of OWNER or ENGINEER in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents. CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.

B. At all times during the progress of the Work, CONTRACTOR shall assign a competent resident superintendent thereto who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. The superintendent will be CONTRACTOR's representative at the Site and shall have authority to act on behalf of CONTRACTOR. All communications given to or received from the superintendent shall be binding on CONTRACTOR.
6.02 Labor; Working Hours

A. CONTRACTOR shall provide competent, suitably qualified personnel to survey, lay out, and construct the Work as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the Site.

* B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday, or any legal holiday without OWNER’s written consent (which will not be unreasonably withheld) given after prior written notice to ENGINEER.

6.03 Services, Materials, and Equipment

A. Unless otherwise specified in the General Requirements, CONTRACTOR shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All Work at the Site shall be performed during regular working hours, and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday, or any legal holiday without OWNER’s written consent (which will not be unreasonably withheld) given after prior written notice to ENGINEER.

6.04 Progress Schedule

A. CONTRACTOR shall adhere to the progress schedule established in accordance with paragraph 2.07 as it may be adjusted from time to time as provided below.

1. CONTRACTOR shall submit to ENGINEER for acceptance (to the extent indicated in paragraph 2.07) proposed adjustments in the progress schedule that will not result in changing the Contract Times (or Milestones). Such adjustments will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the progress schedule that will change the Contract Times (or Milestones) shall be submitted in accordance with the requirements of Article 12. Such adjustments may only be made by a Change Order or Written Amendment in accordance with Article 12.

6.05 Substitutes and “Or-Equals”

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or “or-equal” item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to ENGINEER for review under the circumstances described below.

1. “Or-Equal” Items: If in ENGINEER’s sole discretion an item of material or equipment proposed by CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by ENGINEER as an “or-equal” item, in which case review and approval of the proposed item may, in ENGINEER’s sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

   a. in the exercise of reasonable judgment ENGINEER determines that: (i) it is at least equal in quality, durability, appearance, strength, and design characteristics; (ii) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole, and;

   b. CONTRACTOR certifies that: (i) there is no increase in cost to the OWNER; and (ii) it will conform substantially, even with deviations, to the detailed requirements of the item named in the Contract Documents.
2. Substitute Items

a. If in ENGINEER’s sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an “or-equal” item under paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. CONTRACTOR shall submit sufficient information as provided below to allow ENGINEER to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by ENGINEER from anyone other than CONTRACTOR.

c. The procedure for review by ENGINEER will be as set forth in paragraph 6.05.A.2.d, as supplemented in the General Requirements and as ENGINEER may decide is appropriate under the circumstances.

d. CONTRACTOR shall first make written application to ENGINEER for review of a proposed substitute item of material or equipment that CONTRACTOR seeks to furnish or use. The application shall certify that the proposed substitute item will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified, and be suited to the same use as that specified. The application will state the extent, if any, to which the use of the proposed substitute item will prejudice CONTRACTOR’s achievement of Substantial Completion on time, whether or not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) to adapt the design to the proposed substitute item and whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute item from that specified will be identified in the application, and available engineering, sales, maintenance, repair, and replacement services will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change, all of which will be considered by ENGINEER in evaluating the proposed substitute item. ENGINEER may require CONTRACTOR to furnish additional data about the proposed substitute item.

B. Substitute Construction Methods or Procedures: If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in and expressly required by the Contract Documents, CONTRACTOR may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by ENGINEER. CONTRACTOR shall submit sufficient information to allow ENGINEER, in ENGINEER’s sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by ENGINEER will be similar to that provided in subparagraph 6.05.A.2.

C. Engineer’s Evaluation: ENGINEER will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs 6.05.A and 6.05.B. ENGINEER will be the sole judge of acceptability. No “or-equal” or substitute will be ordered, installed or utilized until ENGINEER’s review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an “or equal.” ENGINEER will advise CONTRACTOR in writing of any negative determination.

D. Special Guarantee: OWNER may require CONTRACTOR to furnish at CONTRACTOR’s expense a special performance guarantee or other surety with respect to any substitute.

* E. ENGINEER’s Cost Reimbursement: ENGINEER will record time required by ENGINEER and ENGINEER’s Consultants in evaluating substitute proposed or submitted by CONTRACTOR pursuant to paragraphs 6.05.A.2 and 6.05.B and in making changes in the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) occasioned thereby. Whether or not ENGINEER approves a substitute item so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER’s Consultants for evaluating each such proposed substitute.

F. CONTRACTOR's Expense: CONTRACTOR shall provide all data in support of any proposed substitute or “or-equal” at CONTRACTOR’s expense.
A. CONTRACTOR shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to OWNER as indicated in paragraph 6.06.B), whether initially or as a replacement, against whom OWNER may have reasonable objection. CONTRACTOR shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom CONTRACTOR has reasonable objection.

* B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to OWNER in advance for acceptance by OWNER by a specified date prior to the Effective Date of the Agreement, and if CONTRACTOR has submitted a list thereof in accordance with the Supplementary Conditions, OWNER’s acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. CONTRACTOR shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued or Written Amendment signed. No acceptance by OWNER of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of OWNER or ENGINEER to reject defective Work.

C. CONTRACTOR shall be fully responsible to OWNER and ENGINEER for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as CONTRACTOR is responsible for CONTRACTOR’s own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between OWNER or ENGINEER and any such Subcontractor, Supplier or other individual or entity, nor shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. CONTRACTOR shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR.

E. CONTRACTOR shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with ENGINEER through CONTRACTOR.

F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for CONTRACTOR by a Subcontractor or Supplier will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and ENGINEER. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in paragraph 5.06, the agreement between the CONTRACTOR and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against OWNER, CONTRACTOR, ENGINEER, ENGINEER’s Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, CONTRACTOR will obtain the same.

* H.

6.07 Patent Fees and Royalties

A. CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of OWNER or ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by OWNER in the Contract Documents. To the
fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER’s Consultants, and the officers, directors, partners, employees or agents, and other consultants of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 Permits

* A. Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. CONTRACTOR shall pay all charges of utility owners for connections to the Work, and OWNER shall pay all charges of such utility owners for capital costs related thereto, such as plant investment fees.

6.09 Laws and Regulations

A. CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither OWNER nor ENGINEER shall be responsible for monitoring CONTRACTOR’s compliance with any Laws or Regulations.

B. If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, CONTRACTOR shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work; however, it shall not be CONTRACTOR’s primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve CONTRACTOR of CONTRACTOR’s obligations under paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work may be the subject of an adjustment in Contract Price or Contract Times. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in paragraph 10.05.

6.10 Taxes

A. CONTRACTOR shall pay all sales, consumer, use, and other similar taxes required to be paid by CONTRACTOR in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 Use of Site and Other Areas

A. Limitation on Use of Site and Other Areas

1. CONTRACTOR shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER’s Consultant, and the officers, directors, partners, employees, agents, and other consultants of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against OWNER, ENGINEER, or any other party indemnified hereunder to the extent caused by or based upon CONTRACTOR's performance of the Work.
B. **Removal of Debris During Performance of the Work:** During the progress of the Work CONTRACTOR shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. **Cleaning:** Prior to Substantial Completion of the Work CONTRACTOR shall clean the Site and make it ready for utilization by OWNER. At the completion of the Work CONTRACTOR shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. **Loading Structures:** CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 **Record Documents**

A. CONTRACTOR shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to ENGINEER for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to ENGINEER for OWNER.

6.13 **Safety and Protection**

A. CONTRACTOR shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

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

B. CONTRACTOR shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property. All damage, injury, or loss to any property referred to in paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of OWNER or ENGINEER or ENGINEER’s Consultant, or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of CONTRACTOR or any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them). CONTRACTOR’s duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and ENGINEER has issued a notice to OWNER and CONTRACTOR in accordance with paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 **Safety Representative**

A. CONTRACTOR shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 **Hazard Communication Programs**

A. CONTRACTOR shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.
6.16 **Emergencies**

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, CONTRACTOR is obligated to act to prevent threatened damage, injury, or loss. CONTRACTOR shall give ENGINEER prompt written notice if CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If ENGINEER determines that a change in the Contract Documents is required because of the action taken by CONTRACTOR in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 **Shop Drawings and Samples**

A. CONTRACTOR shall submit Shop Drawings to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. All submittals will be identified as ENGINEER may require and in the number of copies specified in the General Requirements. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show ENGINEER the services, materials, and equipment CONTRACTOR proposes to provide and to enable ENGINEER to review the information for the limited purposes required by paragraph 6.17.E.

B. CONTRACTOR shall also submit Samples to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers, and the use for which intended and otherwise as ENGINEER may require to enable ENGINEER to review the submittal for the limited purposes required by paragraph 6.17.E. The numbers of each Sample to be submitted will be as specified in the Specifications.

C. Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submittals acceptable to ENGINEER as required by paragraph 2.07, any related Work performed prior to ENGINEER’s review and approval of the pertinent submittal will be at the sole expense and responsibility of CONTRACTOR.

D. **Submittal Procedures**

1. Before submitting each Shop Drawing or Sample, CONTRACTOR shall have determined and verified:

   a. all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

   b. all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;

   c. all information relative to means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto; and

   d. CONTRACTOR shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

2. Each submittal shall bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR’s obligations under the Contract Documents with respect to CONTRACTOR’s review and approval of that submittal.

3. At the time of each submittal, CONTRACTOR shall give ENGINEER specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to ENGINEER for review and approval of each such variation.

   * a.

   * 4.

   * 5.

E. **ENGINEER’s Review**

1. ENGINEER will timely review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample submittals acceptable to ENGINEER. ENGINEER’s review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work,
conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. ENGINEER’s review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. ENGINEER’s review and approval of Shop Drawings or Samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called ENGINEER’s attention to each such variation at the time of each submittal as required by paragraph 6.17.D.3 and ENGINEER has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample approval; nor will any approval by ENGINEER relieve CONTRACTOR from responsibility for complying with the requirements of paragraph 6.17.D.1.

* 4. *
  * a. *
  * b. *
  * c. *
  * d. *

F. Resubmittal Procedures

1. CONTRACTOR shall make corrections required by ENGINEER and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

6.19 CONTRACTOR’s General Warranty and Guarantee

A. CONTRACTOR warrants and guarantees to OWNER, ENGINEER, and ENGINEER’s Consultants that all Work will be in accordance with the Contract Documents and will not be defective. CONTRACTOR’s warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than CONTRACTOR, Subcontractors, Suppliers, or any other individual or entity for whom CONTRACTOR is responsible; or

2. normal wear and tear under normal usage.

B. CONTRACTOR’s obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of CONTRACTOR’s obligation to perform the Work in accordance with the Contract Documents:

1. observations by ENGINEER;

2. recommendation by ENGINEER or payment by OWNER of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by ENGINEER or any payment related thereto by OWNER;

4. use or occupancy of the Work or any part thereof by OWNER;

5. any acceptance by OWNER or any failure to do so;

6. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by ENGINEER;

7. any inspection, test, or approval by others; or

8. any correction of defective Work by OWNER.
6.20 **Indemnification**

A. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER’s Consultants, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage:

1. is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom; and

2. is caused in whole or in part by any negligent act or omission of CONTRACTOR, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of an individual or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such individual or entity.

B. In any and all claims against OWNER or ENGINEER or any of their respective consultants, agents, officers, directors, partners, or employees by any employee (or the survivor or personal representative of such employee) of CONTRACTOR, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for CONTRACTOR or any such Subcontractor, Supplier, or other individual or entity under workers’ compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of CONTRACTOR under paragraph 6.20.A shall not extend to the liability of ENGINEER and ENGINEER’s Consultants or to the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them arising out of:

1. the preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

**ARTICLE 7 - OTHER WORK**

7.01 **Related Work at Site**

A. OWNER may perform other work related to the Project at the Site by OWNER’s employees, or let other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to CONTRACTOR prior to starting any such other work; and

2. if OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in paragraph 10.05.

B. CONTRACTOR shall afford each other contractor who is a party to such a direct contract and each utility owner (and OWNER, if OWNER is performing the other work with OWNER’s employees) proper and safe access to the Site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, CONTRACTOR shall do all cutting,fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this paragraph are for the benefit of utility owners and other contractors to the extent that there are comparable provisions for the benefit of utility owners and other contractors to the extent that there are comparable provisions for the benefit of
CONTRACTOR in said direct contracts between OWNER and such utility owners and other contractors.

C. If the proper execution or results of any part of CONTRACTOR’s Work depends upon work performed by others under this Article 7, CONTRACTOR shall inspect such other work and promptly report to ENGINEER in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of CONTRACTOR’s Work. CONTRACTOR’s failure to so report will constitute an acceptance of such other work as fit and proper for integration with CONTRACTOR’s Work except for latent defects and deficiencies in such other work.

7.02 Coordination

A. If OWNER intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, OWNER shall have sole authority and responsibility for such coordination.

ARTICLE 8 - OWNER’S RESPONSIBILITIES

8.01 Communications to Contractor

A. Except as otherwise provided in these General Conditions, OWNER shall issue all communications to CONTRACTOR through ENGINEER.

8.02 Replacement of ENGINEER

A. In case of termination of the employment of ENGINEER, OWNER shall appoint an engineer to whom CONTRACTOR makes no reasonable objection, whose status under the Contract Documents shall be that of the former ENGINEER.

8.03 Furnish Data

A. OWNER shall promptly furnish the data required of OWNER under the Contract Documents.

8.04 Pay Promptly When Due

A. OWNER shall make payments to CONTRACTOR promptly when they are due as provided in paragraphs 14.02.C and 14.07.C.

8.05 Lands and Easements; Reports and Tests

A. OWNER’s duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.01 and 4.05. Paragraph 4.02 refers to OWNER’s identifying and making available to CONTRACTOR copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been utilized by ENGINEER in preparing the Contract Documents.

8.06 Insurance

A. OWNER’s responsibilities, if any, in respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 Change Orders

A. OWNER is obligated to execute Change Orders as indicated in paragraph 10.03.

8.08 Inspections, Tests, and Approvals

A. OWNER’s responsibility in respect to certain inspections, tests, and approvals is set forth in paragraph 13.03.B.

8.09 Limitations on OWNER’s Responsibilities

A. The OWNER shall not supervise, direct, or have control or authority over, nor be responsible for, CONTRACTOR’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work. OWNER will not be responsible for CONTRACTOR’s failure to perform the Work in accordance with the Contract Documents.
8.10 Undisclosed Hazardous Environmental Condition

A. OWNER’s responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in paragraph 4.06.

8.11 Evidence of Financial Arrangements

A. If and to the extent OWNER has agreed to furnish CONTRACTOR reasonable evidence that financial arrangements have been made to satisfy OWNER’s obligations under the Contract Documents, OWNER’s responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 9 - ENGINEER’S STATUS DURING CONSTRUCTION

9.01 OWNER’S Representative

A. ENGINEER will be OWNER’s representative during the construction period. The duties and responsibilities and the limitations of authority of ENGINEER as OWNER’s representative during construction are set forth in the Contract Documents and will not be changed without written consent of OWNER and ENGINEER.

9.02 Visits to Site

A. ENGINEER will make visits to the Site at intervals appropriate to the various stages of construction as ENGINEER deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of CONTRACTOR’s executed Work. Based on information obtained during such visits and observations, ENGINEER, for the benefit of OWNER, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. ENGINEER will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. ENGINEER’s efforts will be directed toward providing for OWNER a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, ENGINEER will keep OWNER informed of the progress of the Work and will endeavor to guard OWNER against defective Work.

B. ENGINEER’s visits and observations are subject to all the limitations on ENGINEER’s authority and responsibility set forth in paragraph 9.10, and particularly, but without limitation, during or as a result of ENGINEER’s visits or observations of CONTRACTOR’s Work ENGINEER will not supervise, direct, control, or have authority over or be responsible for CONTRACTOR’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work.

9.03 Project Representative

A. If OWNER and ENGINEER agree, ENGINEER will furnish a Resident Project Representative to assist ENGINEER in providing more extensive observation of the Work. The responsibilities and authority and limitations thereon of any such Resident Project Representative and assistants will be as provided in paragraph 9.10 and in the Supplementary Conditions. If OWNER designates another representative or agent to represent OWNER at the Site who is not ENGINEER’s Consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 Clarifications and Interpretations

A. ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents as ENGINEER may determine necessary, which shall be consistent with the intent of and reasonably inferable from the Contract Documents. Such written clarifications and interpretations will be binding on OWNER and CONTRACTOR. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a written clarification or interpretation, a Claim may be made therefor as provided in paragraph 10.05.

9.05 Authorized Variations in Work

A. ENGINEER may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on OWNER and also on CONTRACTOR, who shall perform the Work involved promptly. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of a Field Order, a
Claim may be made therefor as provided in paragraph 10.05.

9.06 Rejecting Defective Work

A. ENGINEER will have authority to disapprove or reject Work which ENGINEER believes to be defective, or that ENGINEER believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. ENGINEER will also have authority to require special inspection or testing of the Work as provided in paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

* B.

9.07 Shop Drawings, Change Orders and Payments

A. In connection with ENGINEER’s authority as to Shop Drawings and Samples, see paragraph 6.17.

B. In connection with ENGINEER’s authority as to Change Orders, see Articles 10, 11, and 12.

C. In connection with ENGINEER’s authority as to Applications for Payment, see Article 14.

9.08 Determinations for Unit Price Work

A. ENGINEER will determine the actual quantities and classifications of Unit Price Work performed by CONTRACTOR. ENGINEER will review with CONTRACTOR the ENGINEER’s preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). ENGINEER’s written decision thereon will be final and binding (except as modified by ENGINEER to reflect changed factual conditions or more accurate data) upon OWNER and CONTRACTOR, subject to the provisions of paragraph 10.05.

9.09 Decisions on Requirements of Contract Documents and Acceptability of Work

A. ENGINEER will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Claims, disputes and other matters relating to the acceptability of the Work, the quantities and classifications of Unit Price Work, the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, and Claims seeking changes in the Contract Price or Contract Times will be referred initially to ENGINEER in writing, in accordance with the provisions of paragraph 10.05, with a request for a formal decision.

B. When functioning as interpreter and judge under this paragraph 9.09, ENGINEER will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by ENGINEER pursuant to this paragraph 9.09 with respect to any such Claim, dispute, or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.07) will be a condition precedent to any exercise by OWNER or CONTRACTOR of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such Claim, dispute, or other matter.

9.10 Limitations on ENGINEER’s Authority and Responsibilities

A. Neither ENGINEER’s authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by ENGINEER in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by ENGINEER shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by ENGINEER to CONTRACTOR, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. ENGINEER will not supervise, direct, control, or have authority over or be responsible for CONTRACTOR’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work. ENGINEER will not be responsible for CONTRACTOR’s failure to perform the Work in accordance with the Contract Documents.

C. ENGINEER will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. ENGINEER’s review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by paragraph 14.07.A will only be to determine generally that their
content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this paragraph 9.10 shall also apply to ENGINEER’s Consultants, Resident Project Representative, and assistants.

*9.11

A. ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

10.01 Authorized Changes in the Work

A. Without invalidating the Agreement and without notice to any surety, OWNER may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

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B. If OWNER and CONTRACTOR are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in paragraph 10.05.

10.02 Unauthorized Changes in the Work

A. CONTRACTOR shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in paragraph 3.04, except in the case of an emergency as provided in paragraph 6.16 or in the case of uncovering Work as provided in paragraph 13.04.B.

10.03 Execution of Change Orders

A. OWNER and CONTRACTOR shall execute appropriate Change Orders recommended by ENGINEER (or Written Amendments) covering:

1. changes in the Work which are: (i) ordered by OWNER pursuant to paragraph 10.01.A, (ii) required because of acceptance of defective Work under paragraph 13.08.A or OWNER’s correction of defective Work under paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by ENGINEER pursuant to paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule as provided in paragraph 6.18.A.

10.04 Notification to Surety

A. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR’s responsibility. The amount of each applicable Bond will be adjusted to reflect the effect of any such change.

10.05 Claims and Disputes

A. Notice: Written notice stating the general nature of each Claim, dispute, or other matter shall be delivered by the claimant to ENGINEER and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. Notice of the amount or extent of the Claim, dispute, or other matter with supporting data shall be delivered to the ENGINEER and the other party to the Contract within 60 days after the start of such event (unless ENGINEER allows additional time for claimant to submit additional or more accurate data in support of such Claim, dispute, or other matter). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of paragraph 12.01.B. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of paragraph 12.02.B.
Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to ENGINEER and the claimant within 30 days after receipt of the claimant's last submittal (unless ENGINEER allows additional time).

B. ENGINEER’s Decision: ENGINEER will render a formal decision in writing within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any. ENGINEER’s written decision on such Claim, dispute, or other matter will be final and binding upon OWNER and CONTRACTOR unless:

1. an appeal from ENGINEER’s decision is taken within the time limits and in accordance with the dispute resolution procedures set forth in Article 16; or

2. if no such dispute resolution procedures have been set forth in Article 16, a written notice of intention to appeal from ENGINEER’s written decision is delivered by OWNER or CONTRACTOR to the other and to ENGINEER within 30 days after the date of such decision, and a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction within 60 days after the date of such decision or within 60 days after Substantial Completion, whichever is later (unless otherwise agreed in writing by OWNER and CONTRACTOR), to exercise such rights or remedies as the appealing party may have with respect to such Claim, dispute, or other matter in accordance with applicable Laws and Regulations.

C. If ENGINEER does not render a formal decision in writing within the time stated in paragraph 10.05.B, a decision denying the Claim in its entirety shall be deemed to have been issued 31 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any.

D. No Claim for an adjustment in Contract Price or Contract Times (or Milestones) will be valid if not submitted in accordance with this paragraph 10.05.

ARTICLE 11 - COST OF THE WORK; CASH ALLOWANCES; UNIT PRICE WORK

11.01 Cost of the Work

A. Costs Included: The term Cost of the Work means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to CONTRACTOR will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items, and shall not include any of the costs itemized in paragraph 11.01.B.

1. Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work under schedules of job classifications agreed upon by OWNER and CONTRACTOR. Such employees shall include without limitation supervisors, foremen, and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers’ compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by OWNER.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers’ field services required in connection therewith. All cash discounts shall accrue to CONTRACTOR unless OWNER deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to OWNER. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to OWNER, and CONTRACTOR shall make provisions so that they may be obtained.

3. Payments made by CONTRACTOR to Subcontractors for Work performed by Subcontractors. If required by OWNER, CONTRACTOR shall obtain competitive bids from subcontractors acceptable to OWNER and CONTRACTOR and shall deliver such bids to OWNER,
who will then determine, with the advice of ENGINEER, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor’s Cost of the Work and fee shall be determined in the same manner as CONTRACTOR’s Cost of the Work and fee as provided in this paragraph 11.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

   a. The proportion of necessary transportation, travel, and subsistence expenses of CONTRACTOR’s employees incurred in discharge of duties connected with the Work.

   b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of CONTRACTOR.

   c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by OWNER with the advice of ENGINEER, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

   d. Sales, consumer, use, and other similar taxes related to the Work, and for which CONTRACTOR is liable, imposed by Laws and Regulations.

   e. Deposits lost for causes other than negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

   f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by CONTRACTOR in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of OWNER. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining CONTRACTOR’s fee.

   g. The cost of utilities, fuel, and sanitary facilities at the Site.

   h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, expressage, and similar petty cash items in connection with the Work.

   i. When the Cost of the Work is used to determine the value of a Change Order or of a Claim, the cost of premiums for additional Bonds and insurance required because of the changes in the Work or caused by the event giving rise to the Claim.

   j. When all the Work is performed on the basis of cost-plus, the costs of premiums for all Bonds and insurance CONTRACTOR is required by the Contract Documents to purchase and maintain.

B. Costs Excluded: The term Cost of the Work shall not include any of the following items:

   1. Payroll costs and other compensation of CONTRACTOR’s officers, executives, principals (of partnerships and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by CONTRACTOR, whether at the Site or in CONTRACTOR’s principal or branch office for general administration of the
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11.02 Cash Allowances

A. It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums as may be acceptable to OWNER and ENGINEER. CONTRACTOR agrees that:

1. the allowances include the cost to CONTRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. CONTRACTOR’s costs for unloading and handling on the Site, labor, installation costs, overhead, profit, and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

B. Prior to final payment, an appropriate Change Order will be issued as recommended by ENGINEER to reflect actual amounts due CONTRACTOR on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 Unit Price Work

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by ENGINEER subject to the provisions of paragraph 9.08.

B. Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR’s overhead and profit for each separately identified item.

* 1.

C. OWNER or CONTRACTOR may make a Claim for an adjustment in the Contract Price in accordance with paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by CONTRACTOR differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect to any other item of Work; and

3. if CONTRACTOR believes that CONTRACTOR is entitled to an increase in
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ARTICLE 12 - CHANGE OF CONTRACT PRICE;
CHANGE OF CONTRACT TIMES

12.01  Change of Contract Price

A. The Contract Price may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the ENGINEER and the other party to the Contract in accordance with the provisions of paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of paragraph 11.03 ); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in paragraph 11.01) plus a CONTRACTOR’s fee for overhead and profit (determined as provided in paragraph 12.01.C).

C. CONTRACTOR’s Fee: The CONTRACTOR’s fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

   a. for costs incurred under paragraphs 11.01.A.1 and 11.01.A.2, the CONTRACTOR’s fee shall be 15 percent;

   b. for costs incurred under paragraph 11.01.A.3, the CONTRACTOR’s fee shall be five percent;

   c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of paragraph 12.01.C.2.a is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and CONTRACTOR will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

   d. no fee shall be payable on the basis of costs itemized under paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

   e. the amount of credit to be allowed by CONTRACTOR to OWNER for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in CONTRACTOR’s fee by an amount equal to five percent of such net decrease; and

   f. when both additions and credits are involved in any one change, the adjustment in CONTRACTOR’s fee shall be computed on the basis of the net change in accordance with paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02  Change of Contract Times

A. The Contract Times (or Milestones) may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Times (or Milestones) shall be based on written notice submitted by the party making the claim to the ENGINEER and the other party to the Contract in accordance with the provisions of paragraph 10.05.

B. Any adjustment of the Contract Times (or Milestones) covered by a Change Order or of any Claim for an adjustment in the Contract Times (or Milestones) will be determined in accordance with the provisions of this Article 12.
12.03 Delays Beyond CONTRACTOR’s Control

A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of CONTRACTOR, the Contract Times (or Milestones) will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in paragraph 12.02.A. Delays beyond the control of CONTRACTOR shall include, but not be limited to, acts or neglect by OWNER, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

12.04 Delays Within CONTRACTOR’s Control

A. The Contract Times (or Milestones) will not be extended due to delays within the control of CONTRACTOR. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of CONTRACTOR.

12.05 Delays Beyond OWNER’s and CONTRACTOR’s Control

A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both OWNER and CONTRACTOR, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be CONTRACTOR’s sole and exclusive remedy for such delay.

12.06 Delay Damages

A. In no event shall OWNER or ENGINEER be liable to CONTRACTOR, any Subcontractor, any Supplier, or any other person or organization, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from:

1. delays caused by or within the control of CONTRACTOR; or

2. delays beyond the control of both OWNER and CONTRACTOR including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God, or acts or neglect by utility owners or other contractors performing other work as contemplated by Article 7.

B. Nothing in this paragraph 12.06 bars a change in Contract Price pursuant to this Article 12 to compensate CONTRACTOR due to delay, interference, or disruption directly attributable to actions or inactions of OWNER or anyone for whom OWNER is responsible.

ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 Notice of Defects

A. Prompt notice of all defective Work of which OWNER or ENGINEER has actual knowledge will be given to CONTRACTOR. All defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 Access to Work

A. OWNER, ENGINEER, ENGINEER’s Consultants, other representatives and personnel of OWNER, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspecting, and testing. CONTRACTOR shall provide them proper and safe conditions for such access and advise them of CONTRACTOR’s Site safety procedures and programs so that they may comply therewith as applicable.

13.03 Tests and Inspections

A. CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. OWNER shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to paragraph 13.04.B shall be paid as provided in said paragraph 13.04.B; and
3. as otherwise specifically provided in the Contract Documents.

* 4.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, CONTRACTOR shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish ENGINEER the required certificates of inspection or approval.

D. CONTRACTOR shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for OWNER’s and ENGINEER’s acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to CONTRACTOR’s purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to OWNER and ENGINEER.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by CONTRACTOR without written concurrence of ENGINEER, it must, if requested by ENGINEER, be uncovered for observation.

F. Uncovering Work as provided in paragraph 13.03.E shall be at CONTRACTOR’s expense unless CONTRACTOR has given ENGINEER timely notice of CONTRACTOR’s intention to cover the same and ENGINEER has not acted with reasonable promptness in response to such notice.

13.04 Uncovering Work

* A. If any Work is covered contrary to the written request of ENGINEER, it must, if requested by ENGINEER, be uncovered for ENGINEER’s observation and replaced at CONTRACTOR’s expense.

* B. If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, CONTRACTOR, at ENGINEER’s request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as ENGINEER may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment. If it is found that such Work is defective, CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and OWNER shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, OWNER may make a Claim therefor as provided in paragraph 10.05. If, however, such Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Times (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

* 1.

13.05 OWNER May Stop the Work

A. If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 Correction or Removal of Defective Work

A. CONTRACTOR shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by ENGINEER, remove it from the Project and replace it with Work that is not defective. CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.07 Correction Period

A. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract
Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for CONTRACTOR’s use by OWNER or permitted by Laws and Regulations as contemplated in paragraph 6.11.A is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER’s written instructions: (i) repair such defective land or areas, or (ii) correct such defective Work or, if the defective Work has been rejected by OWNER, remove it from the Project and replace it with Work that is not defective, and (iii) satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or repaired or may have the rejected Work removed and replaced, and all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR.

B. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications or by Written Amendment.

C. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

D. CONTRACTOR’s obligations under this paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this paragraph 13.07 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitation or repose.

### 13.08 Acceptance of Defective Work

A. If, instead of requiring correction or removal and replacement of defective Work, OWNER (and, prior to ENGINEER’s recommendation of final payment, ENGINEER) prefers to accept it, OWNER may do so. CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to OWNER’s evaluation of and determination to accept such defective Work (such costs to be approved by ENGINEER as to reasonableness) and the diminished value of the Work to the extent not otherwise paid by CONTRACTOR pursuant to this sentence. If any such acceptance occurs prior to ENGINEER’s recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and OWNER shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, OWNER may make a Claim therefor as provided in paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by CONTRACTOR to OWNER.

### 13.09 OWNER May Correct Defective Work

A. If CONTRACTOR fails within a reasonable time after written notice from ENGINEER to correct defective Work or to remove and replace rejected Work as required by ENGINEER in accordance with paragraph 13.06.A, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents, or if CONTRACTOR fails to comply with any other provision of the Contract Documents, OWNER may, after seven days written notice to CONTRACTOR, correct and remedy any such deficiency.

B. In exercising the rights and remedies under this paragraph, OWNER shall proceed expeditiously. In connection with such corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the Site, take possession of all or part of the Work and suspend CONTRACTOR’s services related thereto, take possession of CONTRACTOR’s tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER’s representatives, agents and employees, OWNER’s other contractors, and ENGINEER and ENGINEER’s Consultants access to the Site to enable OWNER to exercise the rights and remedies under this paragraph.

C. All Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by OWNER in exercising the rights and remedies under this paragraph 13.09 will be charged against CON-
TRACTOR, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and OWNER shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, OWNER may make a Claim therefor as provided in paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of CONTRACTOR’s defective Work.

D. CONTRACTOR shall not be allowed an extension of the Contract Times (or Milestones) because of any delay in the performance of the Work attributable to the exercise by OWNER of OWNER’s rights and remedies under this paragraph 13.09.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 Schedule of Values

A. The schedule of values established as provided in paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to ENGINEER. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 Progress Payments

A. Applications for Payments

* 1. At least 20 days before the date established for each progress payment (but not more often than once a month), CONTRACTOR shall submit to ENGINEER for review an Application for Payment filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that OWNER has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect OWNER’s interest therein, all of which must be satisfactory to OWNER.

* 2. Beginning with the second Application for Payment, each Application shall include an affidavit of CONTRACTOR stating that all previous progress payments received on account of the Work have been applied on account to discharge CONTRACTOR’s legitimate obligations associated with prior Applications for Payment.

* 3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. Review of Applications

* 1. ENGINEER will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to OWNER or return the Application to CONTRACTOR indicating in writing ENGINEER’s reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application.

* a. 

* b. 

2. ENGINEER’s recommendation of any payment requested in an Application for Payment will constitute a representation by ENGINEER to OWNER, based on ENGINEER’s observations on the Site of the executed Work as an experienced and qualified design professional and on ENGINEER’s review of the Application for Payment and the accompanying data and schedules, that to the best of ENGINEER’s knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under paragraph 9.08, and to any other qualifications stated in the recommendation); and
c. the conditions precedent to CONTRACTOR’s being entitled to such payment appear to have been fulfilled in so far as it is ENGINEER’s responsibility to observe the Work.

3. By recommending any such payment ENGINEER will not thereby be deemed to have represented that: (i) inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to ENGINEER in the Contract Documents; or (ii) that there may not be other matters or issues between the parties that might entitle CONTRACTOR to be paid additionally by OWNER or entitle OWNER to withhold payment to CONTRACTOR.

4. Neither ENGINEER’s review of CONTRACTOR’s Work for the purposes of recommending payments nor ENGINEER’s recommendation of any payment, including final payment, will impose responsibility on ENGINEER to supervise, direct, or control the Work or for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for CONTRACTOR’s performance of the Work. Additionally, said review or recommendation will not impose responsibility on ENGINEER to make any examination to ascertain how or for what purposes CONTRACTOR has used the moneys paid on account of the Contract Price, or to determine that title to any of the Work, materials, or equipment has passed to OWNER free and clear of any Liens.

5. ENGINEER may refuse to recommend the whole or any part of any payment if, in ENGINEER’s opinion, it would be incorrect to make the representations to OWNER referred to in paragraph 14.02.B.2. ENGINEER may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in ENGINEER’s opinion to protect OWNER from loss because:

   a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;
   b. the Contract Price has been reduced by Written Amendment or Change Orders;
   c. OWNER has been required to correct defective Work or complete Work in accordance with paragraph 13.09; or
   d. ENGINEER has actual knowledge of the occurrence of any of the events enumerated in paragraph 15.02.A.

C. Payment Becomes Due

* 1. Ten days after presentation of the Application for Payment to OWNER with ENGINEER’s recommendation, the amount recommended will (subject to the provisions of paragraph 14.02.D) become due, and when due will be paid by OWNER to CONTRACTOR.

D. Reduction in Payment

1. OWNER may refuse to make payment of the full amount recommended by ENGINEER because:

   a. claims have been made against OWNER on account of CONTRACTOR’s performance or furnishing of the Work;
   b. Liens have been filed in connection with the Work, except where CONTRACTOR has delivered a specific Bond satisfactory to OWNER to secure the satisfaction and discharge of such Liens;
   c. there are other items entitling OWNER to a set-off against the amount recommended; or
   d. OWNER has actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.02.B.5.a through 14.02.B.5.c or paragraph 15.02.A.

2. If OWNER refuses to make payment of the full amount recommended by ENGINEER, OWNER must give CONTRACTOR immediate written notice (with a copy to ENGINEER) stating the reasons for such action and promptly pay CONTRACTOR any amount remaining after deduction of the amount so withheld. OWNER shall promptly pay CONTRACTOR the amount so withheld, or any adjustment thereto agreed to by OWNER and
CONTRACTOR, when CONTRACTOR corrects to OWNER’s satisfaction the reasons for such action.

3. If it is subsequently determined that OWNER’s refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by paragraph 14.02.C.1.

14.03 CONTRACTOR’s Warranty of Title

A. CONTRACTOR warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER no later than the time of payment free and clear of all Liens.

B.

14.04 Substantial Completion

A. When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall notify OWNER and ENGINEER in writing that the entire Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) and request that ENGINEER issue a certificate of Substantial Completion. Promptly thereafter, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of the Work to determine the status of completion. If ENGINEER does not consider the Work substantially complete, ENGINEER will notify CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers the Work substantially complete, ENGINEER will notify CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers the Work substantially complete, ENGINEER will prepare and deliver to OWNER a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. OWNER shall have seven days after receipt of the tentative certificate during which to make written objection to ENGINEER as to any provisions of the certificate or attached list. If, after considering such objections, ENGINEER concludes that the Work is not substantially complete, ENGINEER will within 14 days after submission of the tentative certificate to OWNER notify CONTRACTOR in writing, stating the reasons therefor. If, after consideration of OWNER’s objections, ENGINEER considers the Work substantially complete, ENGINEER will within said 14 days execute and deliver to OWNER and CONTRACTOR a definitively written certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as ENGINEER believes justified after consideration of any objections from OWNER. At the time of delivery of the tentative certificate of Substantial Completion ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless OWNER and CONTRACTOR agree otherwise in writing and so inform ENGINEER in writing prior to ENGINEER’s issuing the definitive certificate of Substantial Completion, ENGINEER’s aforesaid recommendation will be binding on OWNER and CONTRACTOR until final payment.

B. OWNER shall have the right to exclude CONTRACTOR from the Site after the date of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

14.05 Partial Utilization

A. Use by OWNER at OWNER’s option of any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which OWNER, ENGINEER, and CONTRACTOR agree constitutes a separately functioning and usable part of the Work that can be used by OWNER for its intended purpose without significant interference with CONTRACTOR’s performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following conditions.

1. OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR shall certify to OWNER and ENGINEER that such part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. CONTRACTOR at any time may notify OWNER and ENGINEER in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of that part of the Work to determine its status of completion. If ENGINEER does not consider that part of the Work to be substantially complete, ENGINEER will notify OWNER and CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers that part of the Work to be substantially complete,
complete, the provisions of paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

2. No occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of paragraph 5.10 regarding property insurance.

14.06 Final Inspection

A. Upon written notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, ENGINEER will promptly make a final inspection with OWNER and CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 Final Payment

A. Application for Payment

* 1. After CONTRACTOR has, in the opinion of ENGINEER, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, Bonds, certificates or other evidence of insurance certificates of inspection, marked-up record documents (as provided in paragraph 6.12), and other documents, CONTRACTOR may make application for final payment following the procedure for progress payments.

* a.

2. The final Application for Payment shall be accompanied (except as previously delivered) by: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by subparagraph 5.04.B.7; (ii) consent of the surety, if any, to final payment; and (iii) complete and legally effective releases or waivers (satisfactory to OWNER) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in paragraph 14.07.A.2 and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full and an affidavit of CONTRACTOR that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or OWNER’s property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien.

B. Review of Application and Acceptance

1. If, on the basis of ENGINEER’s observation of the Work during construction and final inspection, and ENGINEER’s review of the final Application for Payment and accompanying documentation as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR’s other obligations under the Contract Documents have been fulfilled, ENGINEER will, within ten days after receipt of the final Application for Payment, indicate in writing ENGINEER’s recommendation of payment and present the Application for Payment to OWNER for payment. At the same time ENGINEER will also give written notice to OWNER and CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.09. Otherwise, ENGINEER will return the Application for Payment to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application for Payment.

C. Payment Becomes Due

* 1. Thirty days after the presentation to OWNER of the Application for Payment and accompanying documentation, the amount recommended by ENGINEER will become due and, when due, will be paid by OWNER to CONTRACTOR.

* 2.

14.08 Final Completion Delayed

A. If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed, and if ENGINEER so confirms, OWNER shall, upon receipt of
CONTRACTOR’s final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 Waiver of Claims

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by OWNER against CONTRACTOR, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from CONTRACTOR’s continuing obligations under the Contract Documents; and

2. a waiver of all Claims by CONTRACTOR against OWNER other than those previously made in writing which are still unsettled.

*14.10

* A.

*14.11

* A.

*14.12

* A.

* B.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.01 OWNER May Suspend Work

A. At any time and without cause, OWNER may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to CONTRACTOR and ENGINEER which will fix the date on which Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR shall be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if CONTRACTOR makes a Claim therefor as provided in paragraph 10.05.

15.02 OWNER May Terminate for Cause

A. The occurrence of any one or more of the following events will justify termination for cause:

1. CONTRACTOR’s persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.07 as adjusted from time to time pursuant to paragraph 6.04);

2. CONTRACTOR’s disregard of Laws or Regulations of any public body having jurisdiction;

3. CONTRACTOR’s disregard of the authority of ENGINEER; or

4. CONTRACTOR’s violation in any substantial way of any provisions of the Contract Documents.

* B. If one or more of the events identified in paragraph 15.02.A occur, OWNER may, after giving CONTRACTOR (and the surety, if any) seven days written notice, terminate the services of CONTRACTOR, exclude CONTRACTOR from the Site, and take possession of the Work and of all CONTRACTOR’s tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the Site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and finish the Work as OWNER may deem expedient. In such case, CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by
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OWNER arising out of or relating to completing the Work, such excess will be paid to CONTRACTOR. If such claims, costs, losses, and damages exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such claims, costs, losses, and damages incurred by OWNER will be reviewed by ENGINEER as to their reasonableness and, when so approved by ENGINEER, incorporated in a Change Order. When exercising any rights or remedies under this paragraph OWNER shall not be required to obtain the lowest price for the Work performed.

C. Where CONTRACTOR’s services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

15.03 OWNER May Terminate For Convenience

A. Upon seven days written notice to CONTRACTOR and ENGINEER, OWNER may, without cause and without prejudice to any other right or remedy of OWNER, elect to terminate the Contract. In such case, CONTRACTOR shall be paid (without duplication of any items):

1. for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. for expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. for all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. for reasonable expenses directly attributable to termination.

B. CONTRACTOR shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 CONTRACTOR May Stop Work or Terminate

A. If, through no act or fault of CONTRACTOR, the Work is suspended for more than 90 consecutive days by OWNER or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment within 30 days after it is submitted, or OWNER fails for 30 days to pay CONTRACTOR any sum finally determined to be due, then CONTRACTOR may, upon seven days written notice to OWNER and ENGINEER, and provided OWNER or ENGINEER do not remedy such suspension or failure within that time, terminate the Contract and recover from OWNER payment on the same terms as provided in paragraph 15.03. In lieu of terminating the Contract and without prejudice to any other right or remedy, if ENGINEER has failed to act on an Application for Payment within 30 days after it is submitted, or OWNER has failed for 30 days to pay CONTRACTOR any sum finally determined to be due, CONTRACTOR may, seven days after written notice to OWNER and ENGINEER, stop the Work until payment is made of all such amounts due CONTRACTOR, including interest thereon. The provisions of this paragraph 15.04 are not intended to preclude CONTRACTOR from making a Claim under paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to CONTRACTOR’s stopping the Work as permitted by this paragraph.

ARTICLE 16 - DISPUTE RESOLUTION

16.01 Methods and Procedures

A. Dispute resolution methods and procedures, if any, shall be as set forth in the Supplementary Conditions. If no method and procedure has been set forth, and subject to the provisions of paragraphs 9.09 and 10.05, OWNER and CONTRACTOR may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any dispute.

ARTICLE 17 - MISCELLANEOUS

17.01 Giving Notice

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or
sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 Computation of Times

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 Cumulative Remedies

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 Survival of Obligations

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Agreement.

17.05 Controlling Law

A. This Contract is to be governed by the law of the state in which the Project is located.
SUPPLEMENTARY CONDITIONS
(Adopted March 6, 2014)

GENERAL

General Conditions, Supplementary Conditions, and Special Provisions – The “Standard General Conditions of the Construction Contract” as prepared by the Engineer’s Joint Contract Documents Committee (1996 Edition) has been included in the Contract Documents and will be generally referred to as the General Conditions. These Supplementary Conditions shall “modify” those General Conditions as hereinafter indicated. The Special Provisions shall further “modify” those General Conditions and these Supplementary Conditions.

Conflict Between Contract Documents and “Laws and Regulations” – Any condition, provision, or specification of the Contract Documents held to be void or unenforceable under any Laws or Regulations shall be deemed stricken, and all remaining conditions, provisions, and specifications shall continue to be valid and binding upon the City and the Contractor, who agree that the Contract Documents shall be reformed to replace such stricken condition, provision, or specification with a valid and enforceable condition, provision, or specification that comes as close as possible to expressing the intention of the stricken condition, provision, or specification without violating any Laws or Regulations.

Coordination and Discrepancies Between Contract Documents – The Contract Documents, excluding the Special Provisions and the Drawings, are intended to describe and otherwise provide all of the requirements for the Work necessary to complete the Project in complete coordination and without any discrepancies between those Contract Documents.

- Any discrepancies between any Contract Documents (excluding the Special Provisions and the Drawings) discovered by the Contractor shall be reported to the Engineer and resolved as indicated in GC3.03 or as otherwise determined by the Engineer.
- Any discrepancies between the Special Provisions and any other Contract Documents (excluding the Drawings) shall be resolved in favor of the Special Provisions.
- Any discrepancies between the Drawings and any other Contract Documents (excluding the Special Provisions) shall be resolved in favor of the Drawings.
- Any discrepancies between the Special Provisions and the Drawings shall be reported to the Engineer and resolved as indicated in GC3.03 or as otherwise determined by the Engineer.

Cross-referencing Between Contract Documents – The cross-referencing between Contract Documents and within each document is provided as an aid and convenience to the Contractor and may not be complete. The Contractor shall properly correlate the information among all the various Contract Documents without reliance upon the cross-referencing provided. Cross-references to the General and/or Supplementary Conditions will generally be listed with either the initials “GC” or “SC” before the appropriate paragraph or section number. Cross-references to the General Requirements will generally be listed with the initials “GR” before the appropriate paragraph or section number.

“Modifications” – Wherever it is indicated that a Contract Document “modifies” or is “modified” by another Contract Document, such “modifications” may include amendments, supplements, deletions, additions, alterations, clarifications, and the like. All provisions of a Contract Document which are so “modified” shall remain in full force and effect as “modified.” All provisions of a Contract Document which are not “modified” shall remain in full force and effect.

“MODIFICATIONS” TO THE GENERAL CONDITIONS

A description of each “modification” to the indicated section of the General Conditions is listed in [brackets].

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

1.01A. [Delete the paragraph in the General Conditions and replace it with the following.] Wherever used in these General Conditions or in other Contract or Bidding Documents, the terms listed below have the meanings indicated which are applicable to both the singular and plural thereof. Said terms are generally printed in italics or with initial or all capital letters, but not always. When a term is used in a context consistent with the definition of a hereinafter-defined
term, such term shall have the same meaning as the defined term whether printed in italics or with initial or all capital letters or otherwise.

1.01A.3. Application for Payment – [Add this to the definition in the General Conditions.] The cover sheet for each Application for Payment shall be provided by the Engineer. Accompanying documentation shall be provided by the Contractor and approved by the Engineer. Also known as a Pay Request.

1.01A.9. Change Order – [Add this to the definition in the General Conditions.] Change Orders are subject to final approval by the City Council upon recommendation of the City Engineer and acceptance by the Contractor.

1.01A.17. Drawings – [Add this to the definition in the General Conditions.] The Drawings show the location, character, and dimensions of the prescribed Work, including site plans, layouts, profiles, cross sections, and construction and material details, and the like. Also known as Plans and/or Details.

1.01A.19. Engineer – [Delete the definition in the General Conditions and replace it with the following.] The City Engineer acting directly or through an assistant or other representative duly authorized by the City Engineer. Such assistant or representative acting within the scope of the particular duties assigned, and/or the authority delegated by the City Engineer.

1.01A.20. Engineer’s Consultant – [Modify the definition in the General Conditions as follows.] Engineer’s Consultants may or may not be identified in the Supplementary Conditions or other Contract Documents.

1.01A.22. General Requirements – [Delete the definition in the General Conditions and replace it with the following.] The General Requirements are a Contract Document and the provisions thereof shall pertain to all sections of the Specifications as if written therein.

1.01A.30. Owner – [Delete the definition in the General Conditions and replace it with the following.] The City of Watertown, South Dakota as represented by the City Council.

1.01A.37. Resident Project Representative – [Add this to the definition in the General Conditions.] Also known as Inspector.

1.01A.51. Award – [Add this new definition to the General Conditions.] The acceptance by the City Council of a Bid and designation of the Cities intent to execute a Contract with the Successful Bidder.

1.01A.52. Bid Bond - [Add this new definition to the General Conditions.] A Bond furnished with a Bid as Bid Security.

1.01A.53. Bidder - [Add this new definition to the General Conditions.] A corporation, partnership, individual, or joint venture who submits a Bid directly to the City.

1.01A.54. Bid Form - [Add this new definition to the General Conditions.] The prescribed form on which the Bid of a Bidder is to be submitted.

1.01A.55. Bid Item - [Add this new definition to the General Conditions.] A specific unit of Work for which Bidders submit a unit price as indicated on the Bid Schedule.

1.01A.56. Bid Schedule - [Add this new definition to the General Conditions.] The list of Bid Items, together with estimated quantities located in the Bid Form upon which a Bidder enters its unit prices, item totals, and total Bid price.

1.01A.57. Bid Security - [Add this new definition to the General Conditions.] The security furnished with a Bid as a guarantee that the Bidder will execute the Contract if Awarded as set forth in the Contract Documents.

1.01A.58. Change Proposal - [Add this new definition to the General Conditions.] A request from the Engineer or the Contractor to execute a Change Order.

1.01A.59. City - [Add this new definition to the General Conditions.] The City of Watertown, South Dakota.
1.01A.60. *City Council* - [Add this new definition to the General Conditions.] Duly elected governing body of the City of Watertown, South Dakota.

1.01A.61. *City Engineer* - [Add this new definition to the General Conditions.] The appointed official of the City holding the position of City Engineer or an assistant or other representative duly authorized by the City Engineer.

1.01A.62. *Contract Item* - [Add this new definition to the General Conditions.] A Bid Item identified on the Agreement and indicated on the Bid Schedule for which a unit price is provided. Also known as Pay Item.

1.01A.63. *Details* - [Add this new definition to the General Conditions.] See Drawings.

1.01A.64. *F & I* or *F and I* - [Add this new definition to the General Conditions.] An abbreviation for Furnish and Install as set forth in GC1.02D.

1.01A.65. *Holidays* - [Add this new definition to the General Conditions.] In the City of Watertown, official holidays occur on the first day of January, known as New Year's Day; the third Monday in January, known as Martin Luther King, Jr. Day; the third Monday in February, known as President's Day; the last Monday in May, known as Memorial Day; the fourth day of July, known as Independence Day; the first Monday in September, known as Labor Day; the second Monday in October, known as Native American Day; the eleventh day of November, known as Veterans' Day; the fourth Thursday in November, known as Thanksgiving Day; and the twenty-fifth day in December, known as Christmas Day. When an official holiday falls on Sunday, the following Monday shall be designated as a substitute holiday and observed as an official holiday. When an official holiday falls on Saturday, the preceding Friday shall be designated as a substitute holiday and observed as an official holiday.

1.01A.66. *Inspector* - [Add this new definition to the General Conditions.] See Resident Project Representative.

1.01A.67. *Instructions to Bidders* - [Add this new definition to the General Conditions.] The outlined methods and procedures for preparing and submitting a Bid.

1.01A.68. *Invitation to Bid* - [Add this new definition to the General Conditions.] A public announcement inviting Bids to be submitted for Work to be performed. Such announcement or advertisement will indicate with reasonable accuracy the approximate quantities, character, and location of the Work to be done, as well as the time and place of the opening of Bids.

1.01A.69. *Notice of Substantial Completion* - [Add this new definition to the General Conditions.] A written notice given by the Engineer to the Contractor establishing the date on which the Contractor achieved Substantial Completion and the date by which all Work is to be finally completed and otherwise ready for final payment.

1.01A.70. *Pay Item* - [Add this new definition to the General Conditions.] See Contract Item.

1.01A.71. *Payment Bond* – [Add this new definition to the General Conditions.] The security furnished to the City to guarantee the payment of all financial obligations resulting from the Project as prescribed elsewhere in the Contract Documents.

1.01A.72. *Pay Request* – [Add this new definition to the General Conditions.] See Application for Payment.

1.01A.73. *Performance Bond* – [Add this new definition to the General Conditions.] The security furnished to the City to guarantee the performance of all Work associated with the Project as prescribed elsewhere in the Contract Documents.

1.01A.74. *Plans* - [Add this new definition to the General Conditions.] See Drawings.

1.01A.75. *Special Provisions* – [Add this new definition to the General Conditions.] A Contract Document that amends, supplements, deletes from, adds to, and/or otherwise modifies the General and Supplementary Conditions, the General Requirements, and/or the various Specifications for a specific Project.
1.01A.76. **Successful Bidder** – [Add this new definition to the General Conditions.] The lowest, responsible, and responsive Bidder to whom the City Council Awards a Contract for the Project. A Bidder shall become the Successful Bidder upon receipt of a written Notice of Award from the Engineer.

**ARTICLE 2 – PRELIMINARY MATTERS**

2.03 Commencement of Contract Times; Notice to Proceed

2.03A. [Delete the paragraph in the General Conditions and replace it with the following.] The Contract Times shall commence to run on the date the Contractor actually starts Work at the Project Site, or the date of the Notice to Proceed issued by the Engineer, whichever occurs first. Notice to Proceed shall be issued at any time after the Effective Date of the Agreement solely at the discretion of the City. When allowed, the Contractor may set the date for Notice to Proceed in accordance with the guidelines set forth elsewhere in the Contract Documents.

2.05 Before Starting Construction

2.05B. **Preliminary Schedules:** [Modify the paragraph in the General Conditions as follows.] Contractor shall submit the indicated schedules to Engineer upon request (unless otherwise specified in the General Requirements).

2.06 Preconstruction Conference

2.06A. [Modify the paragraph in the General Conditions as follows.] A preconstruction conference will be held after the Notice of Award is issued but before any Work at the Site begins. However, Work at the Site may begin before the preconstruction conference with the prior approval of the Engineer.

2.07 Initial Acceptance of Schedules

2.07A. [Modify the paragraph in the General Conditions as follows.] Unless otherwise set forth in the Contract Documents, the indicated conference will only occur upon request of the Contractor or the Engineer.

**ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE**

3.01 Intent

3.01D. [Add this new paragraph to the General Conditions.] The Specifications may vary in form, format, and style. Some Specification sections are written in varying degrees of streamlined or declarative style and some sections may be relatively narrative by comparison. Omissions of such words and phrases as “the Contractor shall,” “in conformity with,” “as shown,” or “as specified” are intentional in streamlined sections. Omitted words and phrases shall be supplied by inference. Similar types of provisions may appear in various parts of a section or article within a part depending on the format of the section or article. The Contractor shall not take advantage of any variation of form, format, or style in making claims for extra Work.

**ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS**

4.02 Subsurface and Physical Conditions

4.02A. & 4.02B. [Modify the paragraphs in the General Conditions as follows.] Reports, Drawings, “Technical Data,” and other such information may or may not be identified in the Supplementary Conditions or other Contract Documents. It shall be the Contractors exclusive responsibility to inquire about the existence of any such information and to familiarize itself therewith.

4.06 Hazardous Environmental Conditions at Site

4.06A. & 4.06B. [Modify the paragraphs in the General Conditions as follows.] Reports, Drawings, “Technical Data,” and other such information may or may not be identified in the Supplementary Conditions or other Contract Documents.
It shall be the Contractor’s exclusive responsibility to inquire about the existence of any such information and to familiarize itself therewith.

**ARTICLE 5 – BONDS AND INSURANCE**

**5.01 Performance, Payment, and other Bonds**

5.01A. [Modify the paragraph in the General Conditions as follows.] Contractor’s obligations under the Contract Documents shall include all similar obligations of Subcontractors, Suppliers, and the like. The Performance and Payment Bonds shall further serve as security for the faithful performance and payment of all Subcontractors’, Suppliers’, and the likes’ obligations.

**5.04 Contractor’s Liability Insurance**

5.04A. [Add this to the paragraph in the General Conditions.] All liability insurance shall provide explosion, collapse, and underground coverages where applicable. No exclusions to the coverages with respect to property being under the care, custody, and/or control of the Contractor shall be allowed.

5.04A.7. [Add this new paragraph to the General Conditions.] Claims for damages relating to completed operations and product liability.

5.04B.1. [Modify the paragraph in the General Conditions as follows.] The insurance required by paragraph GC5.04A.7. shall be included with the insurance required by paragraphs GC5.04A.3. through GC5.04A.6. inclusive for the purposes of this paragraph GC5.04B.1.

5.04B.1.a. [Add this new paragraph to the General Conditions.] The entities listed hereafter shall be listed and considered as additional insureds including their respective officers, directors, agents, employees, and the like.

- Watertown, South Dakota (Including the City Engineer or other representative duly authorized by the City Engineer whether directly employed by the City or working under contract with the City.)

5.04B.5. [Replace the word “thirty” with the word “ten” and modify the paragraph in the General Conditions as follows.] Unless otherwise set forth in the Contract Documents, the indicated notice shall be given to the City, the Contractor, and to each other additional insured identified in the Contract Documents, regardless of whether they were issued a certificate of insurance.

5.04B.7. [Modify the paragraph in the General Conditions as follows.] Unless otherwise set forth in the Contract Documents, the indicated evidence shall be given to the City and to every additional insured identified in the Contract Documents regardless of whether they were issued a certificate of insurance. Such evidence shall be given to the City or an additional insured, upon request therefrom.

5.04B.8. [Add this new paragraph to the General Conditions.] With respect to all insurance required by this section 5.04, the Contractor agrees to waive all rights of subrogation against the City, the Engineer, and each additional insured identified in the Contract Documents.

5.04C. [Add this new paragraph to the General Conditions.] The limits of liability for the insurance required by paragraph 5.04 of the General Conditions shall provide the following coverages for not less than the following amounts or greater where required by Laws and Regulation.

5.04C.1. [Add this new paragraph to the General Conditions.] The limits of liability for the insurance required by paragraphs GC5.04A.1. and GC5.04A.2. shall provide the following coverages for not less than the following amounts:

- State: Statutory limit.
- Applicable Federal: Statutory limit.
- Employer’s Liability: $1,000,000.
5.04C.2. [Add this new paragraph to the General Conditions.] The limits of liability for the insurance required by paragraphs GC5.04A.3., GC5.04A.4., and GC5.04A.5. shall provide the following coverages for not less than the following amounts:

- General Aggregate (Except product liability and completed operations coverages.): $1,000,000.
- Products--Completed Operations Aggregate.: $1,000,000.
- Personal and Advertising Injury (Per person or organization.): $1,000,000.
- Each Occurrence (Bodily injury and property damage.): $1,000,000.

5.04C.3. [Add this new paragraph to the General Conditions.] The limits of liability for the insurance required by paragraph GC5.04A.6. shall provide the following coverages for not less than the following amounts:

- Bodily Injury (Each Person.): $1,500,000.
- Bodily Injury (Each Accident.): $1,500,000.
- Property Damage (Each Accident.): $1,500,000.

OR

- Combined Single Limit for Bodily Injury and Property Damage (Each Accident.): $1,500,000.

5.04C.4. [Add this new paragraph to the General Conditions.] The limits of liability for the insurance required by paragraph GC5.04A.7. shall provide the following coverages for not less than the following amounts:

- Completed Operations and Product Liability Aggregate: $1,000,000.

5.04C.5. [Add this new paragraph to the General Conditions.] The contractual liability coverage required by paragraph GC5.04B.4. shall provide the following coverage for not less than the following amounts:

- General Aggregate: $1,000,000.
- Bodily Injury and Property Damage (Each occurrence.): $1,000,000.

5.06 Property Insurance

5.06A. [Modify the paragraph in the General Conditions as follows.] The Contractor, and not the City, shall purchase and maintain all property insurance set forth in this section GC5.06.

5.06A.1. [Add this to the paragraph in the General Conditions.] The insured and the additional insured shall be listed in the insurance coverage by specific name and not by general reference.

5.06A.2. [Add this to the paragraph in the General Conditions.] Additional perils include explosion, collapse, and underground exposures.

5.06A.7. [Modify the paragraph in the General Conditions as follows.] Unless otherwise set forth in the Contract Documents, the indicated notice shall be given to each other additional insured identified in the Contract Documents, regardless of whether they were issued a certificate of insurance.

5.06C. [Modify the paragraph in the General Conditions as follows.] Unless otherwise set forth in the Contract Documents, the indicated notice shall be given to the City, the Contractor, and to each other additional insured identified in the Contract Documents, regardless of whether they were issued a certificate of insurance.

5.07 Waiver of Rights

5.07A. [Add this to the paragraph in the General Conditions.] The waivers of rights shall be limited to the extent the losses and damages are in fact covered under such policies, and to the extent the losses and damages are not covered, or to the extent they exceed the coverage available under such policies, no waiver of rights to the uncovered losses or damages shall be deemed to have occurred.
5.10 Partial Utilization, Acknowledgement of Property Insurer

5.10A.1. [Add this new paragraph to the General Conditions.] All insurance required by the Contract Documents (or by Laws or Regulations) shall remain in full force and effect on all phases of the Work until all Work under the Contract has been completed and final payment has been made, regardless of the City occupying or utilizing any or all portions of the Work.

5.11 [Add this new section to the General Conditions.] No Limit on Contractor’s Responsibilities

5.11A. [Add this new paragraph to the General Conditions.] Nothing contained in any insurance requirements within the Contract Documents shall be construed as limiting the extent of the Contractor’s responsibilities for payment of any and all costs associated with any and all damages resulting from the Contractor’s, Subcontractors’, Suppliers’, and/or the likes’ operations under the Contract. The Contractor agrees that the Contractor shall be solely and completely responsible for the procurement and maintenance of any and all insurance coverage required by the Contract Documents, and that no approval by the City or the Engineer shall operate to the contrary.

ARTICLE 6 – CONTRACTOR’S RESPONSIBILITIES

6.02 Labor; Working Hours

6.02B. [Delete the paragraph in the General Conditions and replace it with the following.] Except as otherwise required for the safety and/or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise indicated in the Contract Documents or required by Laws and Regulations, the Contractor may carry out the Work during “reasonable times.” The Engineer shall have the exclusive authority to determine the “reasonable times” in which the Contractor may carry out the Work. “Reasonable times” shall generally include the daylight hours of any day, including Saturdays, Sundays, and Holidays. The Contractor shall not work outside “reasonable times” without the express permission of the Engineer. The Contractor shall schedule all Work such that the Engineer(s), Engineer’s Consultant(s), Inspector(s), surveyors, and the like can perform their duties during normal business hours as set forth in paragraph SC9.11.

6.05 Substitutes and “Or-Equals”

6.05E. [Modify the paragraph in the General Conditions as follows.] The Engineer and/or Engineer’s Consultant will generally perform these evaluations without Contractor reimbursement to the City. However, the City reserves the Right to be reimbursed by the Contractor when a proposed Substitute requires considerable effort on the part of the Engineer and/or Engineer’s Consultant in properly evaluating the proposal. The Engineer and/or Engineer’s Consultant will notify the Contractor if reimbursement to the City will be required before beginning any evaluations.

6.06 Concerning Subcontractors, Suppliers, and Others

6.06B. [Modify the paragraph in the General Conditions as follows.] When set forth elsewhere in the Contract Documents or requested by the Engineer, the Contractor shall be required to identify all or certain Subcontractors, Suppliers, or other individuals or entities to determine the acceptability thereof.

6.06H. [Add this new paragraph to the General Conditions.] The Contractor shall perform, with its own organization, Work amounting too not less than fifty percent (50%) of the total Contract Price. The Contractor shall not sublet, sell, assign, or otherwise transfer more than fifty percent (50%) of the Work to be performed under the Contract without the prior approval of the Engineer. Certain items of Work may be designated as “specialty items” by the Engineer. Any such “specialty items” performed by Subcontractors may be deducted from the total Contract Price before computing the amount of Work required to be performed by the Contractor with its own organization.

6.08 Permits

6.08A. [Delete the paragraph in the General Conditions and replace it with the following.] Unless otherwise provided in the Special Provisions or elsewhere in the Contract Documents, the Contractor shall obtain and pay for all construction permits, licenses, and the like. The Engineer may assist the Contractor, when necessary, in obtaining such permits,
licenses, and the like. The Contractor shall pay all charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement.

6.17 Shop Drawings and Samples

6.17D.3.a. [Add this new paragraph to the General Conditions.] If a Shop Drawing or Sample submittal indicates a variation from the requirements of the Contract Documents and the Engineer finds such variation to be in the interest of the City or to be so minor as not to adversely affect the Work or the Project design, then the Engineer may approve the Shop Drawing or Sample submittal. No review or approval by the Engineer of any Shop Drawing or Sample submittal shall serve to relieve the Contractor of its responsibilities for executing the Work in strict accordance with the requirements of the Contract Documents unless all proposed variations from said requirements are clearly indicated in the submittal as set forth in the Contract Documents.

6.17D.4. [Add this new paragraph to the General Conditions.] The Contractor shall make all Shop Drawing and Sample submittals adequately in advance of construction requirements to allow ample time for checking, correcting, resubmitting, and rechecking, and to otherwise avoid any delay in the progress of the Work due to Engineers review of submittals.

6.17D.5. [Add this new paragraph to the General Conditions.] Shop Drawing and Sample submittals failing to conform to the requirements of this paragraph GC6.17D., and any other requirements set forth in the Contract Documents, will be returned to the Contractor without action for correction and subsequent re-submittal, and the resulting delay shall be entirely the responsibility of the Contractor.

6.17E.4. [Add this new paragraph to the General Conditions.] The Engineer shall review the Shop Drawing and Sample submittals to determine their general conformance with the requirements of the Contract Documents and/or the Project design, except as otherwise provided. The Engineer's approval of a Shop Drawing or Sample submittal shall not be interpreted as:
   a. permitting any variation whatsoever from the requirements of the Contract Documents, unless the Engineer has given written approval for each specific variation;
   b. relieving the Contractor of its responsibilities for any errors in details, dimensions, or otherwise that may exist in any submittals;
   c. constituting a blanket approval of dimensions, quantities, or details of the material or equipment shown therein; or
   d. approving variations from any additional clarifications, details, or other information previously furnished by the Engineer.

ARTICLE 9 – Engineer’s Status During Construction

9.06 Rejecting Defective Work

9.06B. [Add this new paragraph to the General Conditions.] The acceptance of any materials, equipment, or other Work by the Engineer shall in no way hinder its future rejection should such work subsequently be found defective, or otherwise in noncompliance with the requirements of the Contract Documents.

9.11 [Add this new section to the General Conditions.] Normal Business Hours

9.11A. [Add this new paragraph to the General Conditions.] The Engineer(s), Engineer’s Consultant(s), Inspector(s), surveyors, and the like will perform their duties during normal business hours. Normal business hours shall include from 8:00 AM to 12:00 PM and from 1:00 PM to 5:00 PM, Monday through Friday, excluding Holidays. The Contractor may request in writing to the City that the Engineer(s), Engineer’s Consultant(s), Inspector(s), surveyors, and/or the like perform their respective duties outside of normal business hours. If the City agrees that the Engineer(s), Engineer’s Consultant(s), Inspector(s), surveyors, and/or the like will perform their respective duties outside of normal business hours, then all expenses incurred by the City for duties performed by the Engineer(s), Engineer’s Consultant(s), Inspector(s), surveyors, and/or the like, occasioned by the Contractor’s scheduling of Work on Saturday, Sunday, a Holiday, or otherwise outside of normal business hours on any regular work day, shall be reimbursed to the City by the Contractor.
ARTICLE 10 – Changes in the Work: Claims

10.01 Authorized Changes in the Work

10.01A.1. [Add this new paragraph to the General Conditions.] When the City requests the Contractor to present a proposal to accomplish a change in the Work, the request will be made in the form of a Change Proposal (as distinct from a Work Change Directive) prepared by the Engineer. The Change Proposal will describe the proposed changes in the requirements of the Contract Documents and request the Contractor to propose any necessary changes to the Contract Price and/or Contract Times (or Milestones) as appropriate. Upon receipt of a Change Proposal the Contractor will submit to the Engineer in a timely fashion a proposed breakdown of all cost and/or time changes, as appropriate or otherwise requested by the Engineer. The Engineer will present the Change Proposal, along with the Contractor’s proposed cost and/or time changes, to the City Council and make recommendations concerning the acceptance thereof. If the Change Proposal and the Contractor’s proposed cost and/or time changes are approved by the City Council, the terms thereof will be included in a Change Order.

10.01A.2. [Add this new paragraph to the General Conditions.] When the Contractor desires to propose changes to the Work, it may submit to the Engineer a Change Proposal. Such Change Proposal shall describe the proposed changes in the requirements of the Contract Documents including a breakdown of the Contractor’s proposed cost and/or time changes as appropriate or otherwise requested by the Engineer. The Engineer will present the Contractor’s Change Proposal to the City Council and make recommendations concerning the acceptance thereof. If the Contractor’s Change Proposal is approved by the City Council, the terms thereof will be included in a Change Order.

10.01A.3. [Add this new paragraph to the General Conditions.] The Contractor agrees that the Contractor is not authorized to proceed with any Work covered in a Change Proposal until a subsequent Change Order is properly signed and issued, and that no approval or other indications from the Engineer shall operate to the contrary.

ARTICLE 11 – Cost of the Work; Cash Allowances: Unit Price Work

11.03 Unit Price Work

11.03B.1. [Add this new paragraph to the General Conditions.] All Work described, required, or reasonably inferred in the Contract Documents for the proper completion of the Project shall be considered incidental to one or more of the Contract Items whether readily identifiable with a Contract Item or not. Any and all costs for incidental or other Work shall be included with the unit prices for the various Contract Items as set forth in the Agreement and listed in the Bid Schedule.

ARTICLE 12 – Change of Contract Price; Change of Contract Time

12.02 Change of Contract Times

12.02C. [Add this new paragraph to the General Conditions.] No extension of the Contract Times (or Milestones) will be allowed for additional Work unless such additional Work adversely affects the Contractor’s ability to meet the Contract Times (or Milestones).

12.02D. [Add this new paragraph to the General Conditions.] No extension of the Contract Times (or Milestones) will be allowed for any delays, interferences, disruptions, and the like whether beyond or within the Contractor’s control, unless such delay interference, disruption, or the like actually impedes the Contractor’s ability to progress with a critical portion of the Work thereby adversely affecting the Contractor’s ability to meet the Contract Times (or Milestones).

12.03 Delays beyond the Contractor’s Control

12.03B. [Add this new paragraph to the General Conditions.] The Contractor shall be required to schedule and otherwise plan for normal weather conditions during the Contract Times. No extension of the Contract Times (or Milestones) will be allowed for any delays emanating from or otherwise accountable to normal weather conditions including varying levels of wind, temperature extremes, rain, snow, hail, and other forms of precipitation, and any other weather condition that could reasonably be anticipate.
ARTICLE 13 – Tests and Inspections

13.03 Tests and Inspections

13.03B.4. [Add this new paragraph to the General Conditions.] for inspections, tests, or approvals performed by the Engineer and/or Inspector.

13.04 Uncovering Work

13.04A. [Delete the paragraph in the General Conditions and replace it with the following.] If any Work is covered contrary to the request of the Engineer or as otherwise indicated in paragraph GC13.03E., it must, if requested by the Engineer, be uncovered for observation, inspection or testing by the Engineer or others, and the Contractor shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of the work of others).

13.04B. [Delete the paragraph in the General Conditions and replace it with the following.] If the Contractor has given the Engineer timely notice of the Contractor’s intention to cover any Work and the Engineer has failed to act with reasonable promptness (during normal business hours as set forth in paragraph SC9.11) in response to such notice, then the expense of uncovering such Work shall be paid as set forth in paragraph SC13.04B.1.

13.04B.1. [Add this new paragraph to the General Conditions.] If the Engineer considers it necessary or advisable that covered Work as described in paragraph SC13.04B. be observed by the Engineer or inspected or tested by others, the Contractor, at Engineer’s request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as ENGINEER may require, that portion of the Work in question, furnishing all necessary labor, material, or equipment. If it is found that such Work is defective, the Contractor shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of the work of others). Or in lieu thereof, the City shall be entitled to accept the defective Work in accordance with paragraph GC13.08 in which case the Contractor shall still be responsible for all expenses related to the uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction of all Work (including but not limited to all costs of repair or replacement of the work of others) except for the specific defective Work accepted by the City. If, however, such Work is not found to be defective, the Contractor shall be allowed an increase in the Contract Price and/or an extension of the Contract Times (or Milestones), where directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and/or reconstruction of the Work (including but not limited to all costs of repair or replacement of the work of others). If the parties are unable to agree as to the amount or extent thereof, Contractor may make a claim therefor as provided in paragraph GC10.05.

ARTICLE 14 – Payments to the Contractor and Completion

14.02 Progress Payments

14.02A.1. [Add this to the paragraph in the General Conditions.] The Contractor shall submit its monthly Application for Payment to the Engineer before 5:00 P.M. on the Eighteenth of each month and during the normal business hours as set forth in paragraph SC9.11. If the eighteenth of the month falls on a Saturday, Sunday, or Holiday, the Contractor shall submit its monthly Application for Payment to the Engineer on a prior date during normal business hours as set forth in paragraph SC9.11. Failure of the Contractor to submit an Application for Payment in a form acceptable to the Engineer by the stipulated time shall result in any subsequent Payment to the Contractor being delayed by one month.

14.02A.2. [Delete the paragraph in the General Conditions and replace it with the following.] The Engineer will provide the Contractor with the Application for Payment form to be used for progress payments. The Contractor shall sign and submit the Application for Payment form including therewith such documentation as the Engineer may deem necessary for the computation of the total amount due the Contractor. For progress payments, the Engineer and not the Contractor shall enter the values in the table on the cover sheet of the Application for Payment form based on the corrected
documentation included. Such documentation shall list the item number, description, original estimated quantity, unit price, and original item total price for every Contract Item identified in the Agreement and described in the Bid Schedule. Each item of Work from an approved Change Order or Written Amendment shall be similarly listed in the accompanying documentation. For every Contract Item including approved Change Order or Written Amendment items, the quantity completed up to and including the date of the Application, and the item total price for quantities completed shall be calculated and listed in the accompanying documentation. Supporting documentation shall further state the original Contract Price, the current Contract Price as modified by Change Order(s) or Written Amendment(s), and the summation of the item total prices for quantities completed.

14.02A.3. [Delete the paragraph in the General Conditions and replace it with the following.] The Engineer shall have the exclusive authority to establish the amount of retainage necessary with each progress payment. Generally, the amount of retainage for all progress payments shall be ten percent (10%) of the total amount due the Contractor but not more than five percent (5%) of the Contract Price as modified by Change Order(s) or Written Amendment(s), and unless otherwise established by the Engineer.

14.02B.1. [Delete the paragraph in the General Conditions and replace it with the following.] Upon receipt of an Application for Payment, the Engineer will review the Application, mark any corrections on the accompanying documentation the Engineer determines to be necessary, establish and calculate the retainage, enter the appropriate values in the table on the Application, sign the Application, and submit, with a recommendation for payment, the corrected Application for Payment with accompanying documentation to the City Finance Officer, with a copy thereof delivered to the Contractor. If the Engineer upon review determines the Application for Payment to be unacceptable, it will be returned to the Contractor (with written indication of the reasons for rejection), for correction and subsequent resubmittal. Such rejection of an Application by the Engineer shall not relieve the Contractor of its responsibility to submit an Application for Payment in a form acceptable to the Engineer by the stipulated time, and may result in any subsequent Payment to the Contractor being delayed by one month.

14.02B.1.a. [Add this to the paragraph in the General Conditions.] The Engineer shall deduct from the amount due the Contractor liquidated damages as set forth in paragraph SC14.12.

14.02B.1.b. [Add this to the paragraph in the General Conditions.] Progress Payments will not be processed if the total payment due to the Contractor amounts to $1,000 or less.

14.02C1. [Delete the paragraph in the General Conditions and replace it with the following.] The amount recommended for payment by the Engineer as a result of an Application for Payment shall become due on the next tenth day of the month after such Application for Payment was submitted to the Engineer in an acceptable form before the stipulated time. Upon payment becoming due, the City (subject to the provisions of paragraph GC14.02D.) shall deliver payment to the Contractor.

14.03 The Contractor’s Warranty of Title

14.03B. [Add this new paragraph to the General Conditions.] If the Engineer or the City considers it necessary or advisable, the Engineer may, as a condition of acceptance of an Application for Payment, require proof that title to all Work, materials, and equipment covered by such Application or prior Application, whether incorporated in the Project or not, shall pass to the City free and clear of all possibility of Liens. When so required, the Contractor shall provide complete and legally effective releases or waivers of all Lien rights arising out of or otherwise concerning the Project. In lieu of the releases or waivers of Liens and when approved by the City, the Contractor may provide proof of free and clear title as set forth in paragraph GC14.07A.3.

14.04 Substantial Completion

14.04A. [Delete the paragraph in the General Conditions and replace it with the following.] When the Contractor considers the entire Work ready for its intended use the Contractor shall notify the Engineer in writing that the entire Work is Substantially Complete (except for any items specifically listed therein by the Contractor as incomplete) and request that the Engineer issue a Notice of Substantial Completion. Promptly thereafter, the Engineer, and possibly others (and the Contractor if requested by the Engineer or the Contractor) shall inspect the Work to determine the status of completion. If the Engineer does not consider the Work Substantially Complete, the Engineer will thereafter notify the Contractor giving the reasons therefore. If the Engineer considers the Work Substantially Complete (whether
requested by the Contractor or not), the Engineer will prepare and deliver to the Contractor a Notice of Substantial Completion that shall fix the date of Substantial Completion and set the date for final completion. There shall be attached to such Notice a “punch” list of items to be completed or corrected before final payment. The Engineer may add items to the “punch” list at any time until final completion of the Project occurs as indicated by the Contractor receiving final payment. The Contractor shall be solely responsible for the security, operation, safety, protection, maintenance, and insurance of the Work until final completion of the Project occurs as indicated by the Contractor receiving final payment.

14.07 Final Payment

14.07A.1. [Modify the paragraph in the General Conditions as follows.] The Contractor shall submit Application for (final) Payment in accordance with the procedures set forth in paragraph SC14.07A.1.a.

14.07A.1.a. [Add this to the paragraph in the General Conditions.] The Engineer will provide the Contractor with the Application for Payment form to be used for final payment. The Contractor shall sign and submit the Application for Payment form including therewith such documentation as the Engineer may deem necessary for the computation of the total amount due the Contractor. For final payment, the Contractor shall enter the values in the table on the Application for Payment form based on the documentation included. Such documentation shall list the item number, description, original estimated quantity, unit price, and original item total price for every Contract Item identified in the Agreement and described in the Bid Schedule. Each item of Work from an approved Change Order or Written Amendment shall be similarly listed in the accompanying documentation. For every Contract Item including approved Change Order or Written Amendment items, the quantity completed up to and including the date of the Application, and the item total price for quantities completed shall be calculated and listed in the accompanying documentation. Supporting documentation shall further state the original Contract Price, the current Contract Price as modified by all Change Order(s) and Written Amendment(s).

14.07C.1. [Delete the paragraph in the General Conditions and replace it with the following.] Upon the City’s receipt of an Application for (final) Payment with all required accompanying documentation, payment as recommended by the Engineer will become due as indicated in paragraph SC14.07C.2., and when due, will be paid by the City to the Contractor.

14.07C.2. [Add this new paragraph to the General Conditions.] Final payment will become due on the tenth day of the month following the proper submittal of an acceptable Application for (final) Payment (along with all required accompanying documentation) to the Engineer before the eighteenth day of the previous month. If an acceptable Application for (final) Payment (along with all required accompanying documentation) is submitted to the Engineer after the eighteenth of the month, final payment will become due after an additional month.

14.10 [Add this new section to the General Conditions.] Substantial Completion Date or Milestones

14.10A. [Add this new paragraph to the General Conditions.] The Contractor shall have the Work (or any specified portions of the Work) Substantially Completed by the date (or dates) set forth in the Agreement. When the Agreement indicates a specific number of days to Substantially Complete the Work (or any specified portions of the Work), the Substantial Completion date (or dates) shall be calculated from the date of Notice to Proceed as set forth in paragraph GC17.02. If the Contractor fail to Substantially Complete the Work (or any specified portions of the Work) on or before the agreed upon date (or dates) as modified in accordance with paragraph GC12.02, liquidated damages shall be assessed to the Contractor as set forth in paragraph SC14.12.

14.11 [Add this new section to the General Conditions.] Final Completion Date

14.11A. [Add this new paragraph to the General Conditions.] The Contractor shall have all Work fully completed and otherwise ready for final payment (in accordance with paragraph GC14.07B.) before the final completion date. The final completion date shall be thirty (30) days (as calculated in accordance with paragraph GC17.02) from the date the Engineer determines the Work to be Substantially Complete. If the Contractor fails to fully complete the Work on or before the final completion date as modified in accordance with paragraph GC12.02, liquidated damages shall be assessed to the Contractor as set forth in paragraph SC14.12.
14.12 [Add this new section to the General Conditions.] **Liquidated Damages**

14.12A. [Add this new paragraph to the General Conditions.] Time is an essential element of the Project. It is important that the Contractor completes the Work (or any specified portions of the Work) by the Substantial Completion date (or dates) and/or the final completion date set forth in the Contract Documents. The public is subjected to detriment and inconvenience whenever full use of the Project cannot be made because the Work (or any specified portions of the Work) is incomplete. Additionally, the cost to the City for the administration of the Project, including engineering, inspection, and the like will be increased as the time to complete the Work (or any specified portions of the Work) is increased. Therefore, liquidated damages as set forth in the following table, shall be deducted from the amount due or that may become due the Contractor, for each and every day that the Work (or any specified portions of the Work) remains uncompleted after the Substantial Completion date (or dates) and/or after the final completion date as applicable. The City allowing the Contractor to continue the Work (or any specified portions of the Work) under the Contract after the Substantial Completion date (or dates) and/or the final completion date shall in no way be construed as a waiver by the City of its right to assess liquidated damages.

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14.12B. **No Proof of Liquidated Damages** [Add this new paragraph to the General Conditions.] Liquidated damages shall be due the City from the Contractor because of inconveniences to the public, added costs to the City, and the like resulting from the Contractor’s failure to complete the Work (or any specified portions of Work) within the Contract Times. The Contractor recognizing the difficulties involved in proving the actual losses suffered by the City and the public, therefore agrees to pay the City the amount of liquidated damages indicated in the Contract Documents regardless of the actual amount of damages sustained.

**ARTICLE 15 – Suspension of Work and Termination**

15.02 The City May Terminate for Cause

15.02B. [Delete the paragraph in the General Conditions and replace it with the following.] If one or more of the events identified in paragraph GC15.02A. occur, The City will provide written notice to the Contractor and the Surety to arrange a conference with the Contractor and the Surety to address the Contractor’s failure to perform the Work. The conference shall not be held earlier than seven (7) days, or later than fifteen (15) days from issuance of said notice.

If the City, the Contractor, and the Surety do not agree to allow the Contractor to proceed to perform the Work under the Contract, the City may, to the extent permitted by Laws and Regulations, declare the Contractor default and formally terminate the Contractor’s right to complete the Work under the Contract. Contractor default shall not be declared earlier than twenty (20) days after the Contractor and the Surety have received notice of the conference to address the Contractor’s failure to properly perform the Work under the Contract.
If the Contractor’s services are terminated, the Surety shall be obligated to take over and perform the Work under the Contract. If the Surety does not commence performance thereof within fifteen (15) days after date of notice to the Contractor that its services have been terminated, or if the Surety has taken over for the Contractor and while prosecuting the Work in lieu of the Contractor, any one or more the events cited in GC15.02.A. occur, then the City, without process or action at law, may take over any portion of the Work and complete it as described hereafter. If the City completes the Work, the City may exclude the Contractor from the Site and take possession of the Work and of all the Contractor’s tools, appliances, construction equipment, machinery, and the like present at the Site and use the same to the full extent they could be used by the Contractor (without liability to the Contractor for trespass or conversion), incorporate into the Work all materials, equipment, and the like stored at the site or for which the City has paid the Contractor but which are stored elsewhere, and finish the Work as the City may deem expedient.

Whether the City or the Surety completes the Work, the Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the total of all claims, costs, losses, and damages sustained by the City arising out of or resulting from completing the Work, such excess will be paid to the Contractor. If such claims, costs, losses, and damages exceed such unpaid balances, the Contractor shall pay the difference to the City. Such claims, costs, losses, and damages incurred by the City will be reviewed by the Engineer as to their reasonableness and when so approved by the Engineer incorporated in a Change Order, provided that when exercising any rights or remedies under this paragraph, the City shall not be required to obtain the lowest price for the Work performed.

Neither the City, the Engineer, nor any of their respective consultants, agents, officers, directors, or employees, shall be in any way liable or accountable to the Contractor or the Surety for the method by which the completion of the said Work, or any portion thereof, may be accomplished or for the price paid therefore.

The City, notwithstanding the method used in completing the Contract, shall not forfeit the right to recover liquidated damages from the Contractor or the Surety for the Contractor’s failure to timely complete all Work under the Contract. The Contractor shall not be entitled to any claim for damages because of the methods used by the City in completing the Work under the Contract.

Maintenance of the Work shall continue to be the Contractor’s and/or the Surety’s responsibilities as provided for in the Bond requirements of the Contract Documents, or any special guarantees provided for in the Contract Documents, or any other obligations otherwise prescribed by Laws and Regulations.

ARTICLE 17 – Miscellaneous

17.06 [Add this new section to the General Conditions.] Unemployment Compensation

17.06A. [Add this new paragraph to the General Conditions.] In accordance with SDCL 5-18-17, the Contractor shall furnish the City prior to final payment, certification from the Department of Labor indicating payment of unemployment compensation contributions and interest due on account of the performance of the Work under the Contract. The Contractor may obtain such certification by contacting the following:

South Dakota Department of Labor
Unemployment Insurance Division
PO Box 1730, Aberdeen, SD 57401
Telephone: 605-622-2312

17.07 [Add this new section to the General Conditions.] Coordination with Railroads

17.07A. [Add this new paragraph to the General Conditions.] The Contractor shall not perform any Work on property owned by a railroad without the express written permission of such railroad. Whenever the Contractor’s operations occur on or adjacent to property owned by a railroad, the Contractor shall obtain all permits, insurance, and the like as may be required by such railroad, and otherwise perform all Work in strict compliance with the requirements of such railroad.
17.07A.1. [Add this new paragraph to the General Conditions.] The Contractor agrees that the Contractor is not authorized to proceed with any Work on property owned by a railroad without the express written permission of such railroad, and that no approval or other indications from the Engineer shall operate to the contrary.

17.08 [Add this new section to the General Conditions.] Coordination with the South Dakota Department of Transportation (SD-DOT)

17.08A. [Add this new paragraph to the General Conditions.] The Contractor shall not perform any Work on property owned by the SD-DOT without the express written permission of the SD-DOT. Whenever the Contractor’s operations occur on or adjacent to property owned by the SD-DOT, the Contractor shall obtain all permits, insurance, and the like as may be required by the SD-DOT, and otherwise perform all Work in strict compliance with the requirements of the SD-DOT.

17.08A.1. [Add this new paragraph to the General Conditions.] The Contractor agrees that the Contractor is not authorized to proceed with any Work on property owned by the SD-DOT without the express written permission of the SD-DOT, and that no approval or other indications from the Engineer shall operate to the contrary.

17.09 [Add this new section to the General Conditions.] Assignment of Rights

17.09A. [Add this new paragraph to the General Conditions.] The City and the Contractor each binds itself, its partners, successors, assigns, and legal representative to the other party, its partners, successors, assigns, and legal representatives in respect to all conditions, provisions, specifications, covenants, agreements, and obligations contained in the Contract Documents. No assignment by the City or the Contractor of any rights under or interests in the Contract will be binding on the other party without the written consent of such other party, and specifically, but without limitation, moneys that are or may become due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty, obligation, or responsibility under the Contract Documents.
GENERAL REQUIREMENTS
Adopted July 19, 2011

1. SCOPE

These General Requirements describe procedures and methods for furnishing labor, materials, equipment, tools, and services for the construction of the Project. The provisions of the General Requirements shall pertain to all sections of the Specifications as if written therein. These General Requirements shall be superseded and/or “modified” by any requirements set forth in the Special Provisions or the Drawings.

2. UTILITIES AND OTHER ENCUMBRANCES

GENERAL - All construction shall be performed in strict accordance with these requirements and the requirements of SDCL 49-7A. Wherever an issue arises which this specification does not address, a meeting with the Contractor(s), the Engineer(s), and representatives for the respective utility facility or other encumbrance will be held to resolve the situation.

LOCATION OF UTILITIES AND OTHER ENCUMBRANCES - No construction shall occur on the Project until all legally required utility locates have been performed in accordance with the Contract Documents and “Laws and Regulations.”

(a) APPROXIMATE LOCATIONS - The approximate location of all known utility facilities and other structures or encumbrances to the Project, both public and private, will be shown in the Plans or described in the Special Provisions. However, the responsibility for determining the accuracy and/or completeness of the utility facilities or other encumbrances shown and/or described, shall rest exclusively with the Contractor.

(b) SOUTH DAKOTA ONE-CALL - All utility locates shall be arranged through the South Dakota One-Call system. However, where necessary or otherwise applicable, the Contractor shall have the exclusive responsibility for contacting and/or notifying any and all utility operators, owners of other encumbrances, and the like, for the purposes of accurately identifying, and locating the utility or other encumbrance.

South Dakota One-Call Locate Phone Number 1(800) 781-7474
South Dakota One-Call Locate Facsimile Number 1(800) 873-3954
South Dakota One-Call Administrative Phone Number 1(800) 873-3588

PROTECTION OF UTILITIES AND OTHER ENCUMBRANCES - The Contractor shall be solely responsible for the protection of all utility facilities or other encumbrances (including “underground” utility facilities and other encumbrances) located at or contiguous to the Project Site whether public or private. The Contractor shall take all necessary steps to support, protect, remove, and/or relocate all exposed or otherwise affected utility facilities or other encumbrances in compliance with the Contract Documents.

(a) HAND DIGGING - All underground utility facilities and other encumbrances shall be precisely exposed using shovels and other hand tools to verify its exact location before mechanical excavation equipment is used. Damage to underground utilities that occur as a result of hand digging may be repaired by the utility operator at no cost to the Contractor provided the repair is minor. If the repair is deemed excessive by the utility operator, all costs associated with the repair will be paid by the Contractor in accordance with “Laws and Regulations” and without additional compensation from the City of Watertown.

(b) HORIZONTAL CLEARANCE DURING EXCAVATION - The Contractor shall maintain a minimum horizontal clearance of eighteen inches between a marked underground facility and the cutting edge of any mechanical excavation equipment. Wherever excavation is required within eighteen horizontal inches of an underground facility or other encumbrance, the Contractor shall precisely expose the facility with hand tools and shall protect and support the facility before further excavation with mechanical equipment.

UTILITY AND OTHER CONFLICTS - In general, utilities and other encumbrances in direct or indirect conflict with the planned construction of the Project will be moved, held, or adjusted by the utility operator, the owner of the encumbrance, or their designate at their expense unless otherwise provided in the Special Provisions or in the Plans. However, no utility facilities or other encumbrances will be relocated or adjusted solely for the convenience of the Contractor. Where necessary, additional procedures for resolving conflicts will be outlined in the Special Provisions, or
the Plans. All expenses for moving, holding, or adjusting of utilities and other encumbrances will be paid by the utility operator.

(a) **ANTICIPATED CONFLICT** - Every known or anticipated utility or other encumbrance that will potentially conflict with the construction of the Project will be identified in the Plans or the Special Provisions along with the procedure for resolving the conflict. *Unless otherwise defined in the Special Provisions, the Bid Form, or the Drawings, the entire cost of investigation and any necessary protection, support, removal or relocation of any utility or other encumbrance adequately identified in the Contract Documents shall not be paid for directly, but shall be considered subsidiary to other Pay Items.*

(b) **UNANTICIPATED CONFLICT** - If an unanticipated utility or other encumbrance is encountered which conflicts with the construction of the Project, the Contractor shall immediately suspend construction and notify the Engineer. In those instances where relocation or reconstruction of the utility or other encumbrance is impracticable, the Engineer may order a deviation from the Contract Documents. *The Contractor may be entitled to additional compensation because of an unanticipated conflict. The Contractor shall submit Change Proposal to the Engineer in accordance with GC10.01A.2.*

(c) **NOTIFICATION OF CONFLICTS** - The Contractor shall determine and/or verify the identity and location of all utilities or other encumbrances, both anticipated and unanticipated, which conflict with, or are otherwise adversely affected, by the construction of the Project. The Contractor shall be solely responsible for notifying the owner of any utility or other encumbrances of any situation that may expose or otherwise endanger the existing utility or other encumbrance. When modifications to a utility facility or other encumbrance are shown in the Plans, or identified in the Special Provisions, the Contractor shall give the utility operator, or owner of the encumbrance, a minimum of five working days notice to call for locates, and arrange for the necessary labor and materials to perform the work.

**COORDINATION OF ACTIVITIES** - The Contractor shall coordinate all work on the Project with the appropriate utility operators or the owners of any encumbrances. Work to be preformed by utility operators or the owner of other encumbrances will be scheduled during normal business hours as set forth in GC9.11A. Any extra expenses incurred by the utility operators or the owners of any encumbrances because of construction activities outside normal business hours shall be paid by the Contractor without additional compensation from the City.

**REPAIR OF DAMAGED UTILITIES** - The Contractor shall repair or cause to be repaired all utility facilities, or other private or public structures damaged during the course of construction in accordance with Laws and Regulations,” and at no cost to the City. Utility facilities damaged by the Contractor in violation of “Laws and Regulations” will be repaired as directed by the utility operator, with all expenses, penalties, or other charges paid by the Contractor. Utility facilities that are damaged and covered up or otherwise hidden by the Contractor may result in the Contractor being prosecuted to the fullest extent of the law.

### 3. WATER MAINS AND SERVICES

**WATER MAIN RELOCATIONS** – The Contractor will relocate water mains including fittings, as set forth in the Drawings or the Special Provisions.

**FIRE HYDRANT RELOCATIONS** – The Water Department will relocate fire hydrants as set forth in the Drawings or the Special Provisions.

**WATER SERVICES** – The water service lines (from water main to service entrance) are not property of Municipal Utilities, they are owned by the water customer. Any dealing with the water service line shall be addressed to the water customer. If the Contractor exposes an existing leaky water service line, the customer and the Water Department shall be notified. It is the responsibility of the property owner to get the service line repaired. If the customer does not have the line repaired, the Water Department will shut the water customer’s water off at the water main. If the Contractor damages or moves a service line, it shall be up to the Contractor to repair the water service line. The Contractor shall use type K copper material. If the Contractor exposes a lead or galvanized water service line, the Water Department shall be notified. The Water Department will contact the property owner in writing stating they have a lead or galvanized water service line.
WATER AND SEWER MAIN SEPARATION –

(a) **HORIZONTAL SEPARATION** – Sewers shall be laid at least 10 feet (3.0 m) horizontally from any existing or proposed water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot (3.0 m) separation, the Department may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the sewer closer to a water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the water main is at least 18 inches (450 mm) above the top of the sewer.

If it is impossible to obtain proper horizontal separation as described above, both the water main and sewer shall be constructed of slip-on or mechanical joint pipe complying with public water supply design standards of the Department and be pressure tested to 150 psi (1034 kPa) to assure water tightness before backfilling.

(b) **VERTICAL SEPARATION** –

1) Sewers Crossing Under Water Mains – The sewer shall be laid to provide a minimum of 18 inches (450 mm) from the top of the sewer to the bottom of the water main. The crossing shall be arranged so the sewer joints will be equidistant and as far as possible from the water main.

2) Sewers Crossing Over or Less than 18 Inches Under Water Mains – Either the water main or the sewer main shall be encased in a watertight carrier pipe that extends 10 feet (3.0 m) on both sides of the crossing, measured perpendicular to the water main. The carrier pipe shall be PVC, ABS, or HDPE, and the ends sealed with a rubber gasket or boot.

3) A reinforced concrete pipe (RCP) storm sewer may cross below a water main with a separation of less than 18 inches or at any height above a water main provided the joints on the RCP within 10 feet of either side of the water main are assembled with:
   a) Preformed butyl rubber sealant meeting federal specification #SS-S-210A and AASHTO M 198, and each of these joints are encased with a minimum 2-foot wide by 6-inch thick concrete collar centered over the joint and reinforced with the equivalent steel area as that in the RCP. Encasement of the water main will not be required when the RCP joints are collared within the 20-foot section.
   b) An O-ring that conforms to ASTM C 443 specifications.
   c) A strip of impermeable material held in place with stainless steel bands and tested to 5 psi prior to the storm sewer being put into use.

COVER – All water mains and the service lines shall have six feet or more of cover.

WATER OUTAGE – In case of a planned water outage, the Water Department requires a two workday notice. This will give the department time to notify their customers of the planned outage, so their water customers can make special arrangements.

COMMON TRENCH FOR SERVICE LINES – All sewer service lines within public right-of-way shall be installed at least ten feet horizontally, from any existing or proposed water service line. Any variation to this requirement is subject to the approval of the City Engineer. On private property, a sewer service line may be laid in the same trench with a water service line provided the water service line is located above the sewer service line on a bench of solid earth. In such a case, the elevation of the crown of the sewer service line shall be at least 12 inches below the invert of the water service line with 24″ being preferred. The sewer service line and water service line shall not have less than 12″ horizontal distance between the piping with 24″ being preferred. Whenever sewer service lines must cross under water service lines, the sewer service line shall be laid at such an elevation that the crown of the sewer service line is at least 12” below the invert of the water service line with 24” being preferred.

MATERIAL SPECIFICATIONS

- Mains that are lowered or raised, for example—45’s and/or 90’s, Class 150 AWWA C-900 pipe shall be used and must conform to the requirements of AWWA C-900-81. Pipe shall be same outside diameter as cast iron pipe. Pipe material conforms to ASTM D-1784 and shall carry National Sanitation Seal for Potable Water Pipe.
- For new main—horizontal runs—Polyvinyl Chloride (PVC) Pipe, Class 200 PVC 1120, 200 PSI at 73 degrees, ASTM D-2241, SDR.21 shall be used.
- All fittings for water pipe shall be ductile iron. Fittings shall conform to requirements of AWWA C-153 and ANSI 21.53. All fittings shall be cement mortar lined and conform to AWWA C-104 and ANSI A21.4. Fittings shall be restrained. All direct bury fittings shall be wrap polyethylene encasements conforming to AWWA C-105.
• Insulation between water mains and storm sewers shall be a high-density 2” foam sheet with an R factor greater than or equal to 10.

4. CONTRACTOR’S WATER SUPPLY

GENERAL – The Contractor shall comply with all rules and guidelines of the Watertown Municipal Utilities Water Department regarding the supply and use of water.

5. ENVIRONMENTAL PROTECTION

GENERAL – The Contractor shall comply with all Laws and Regulations controlling pollution of the environment, and shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs from harmful materials and to prevent pollution of the atmosphere.

EROSION CONTROL – The Contractor shall make provisions to protect against erosion of soil and granular materials into properties, drainage ways, and sewer systems by use of erosion control devices as necessary or as directed by the Engineer.

SOUND CONTROL REQUIREMENTS – All engines, used for any purpose on the Project or related to the Project, shall be equipped with a muffler of a type recommended by the manufacturer and maintained in a satisfactory working condition.

6. SURFACE RESTORATION

GENERAL – Unless stated specifically to the contrary in the Special Provisions, the Contractor shall replace all surface material and shall restore paving, curbing, sidewalks, gutters, fences, trees, sod, topsoil and other items disturbed, to a condition equal to that before the Work began; furnishing all labor, materials and equipment necessary to do this Work. Traveled streets shall be kept open and maintained by the Contractor after backfilling and before surfacing or final inspection. The cost of all such Work shall not be paid for directly but shall be absorbed into the unit price of another appropriate item.

Before beginning any excavation on graveled streets, the Contractor shall windrow all existing salvageable gravel and it shall be relayed, shaped, and compacted upon completion of project. Avoid any mixing of clay or other foreign materials with the gravel. If the Contractor does not salvage the existing gravel, it shall be responsible for replacing additional gravel at its expense in an approved manner.

GENERAL SEEDING – Contractor shall seed and fertilize all disturbed areas after the topsoil is placed to the satisfaction of the Engineer. The pure live grass seed mixture to be used shall be as follows:

<table>
<thead>
<tr>
<th>Type of Seed</th>
<th>Pure Live Seed (PLS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kentucky Blue Grass</td>
<td>2.40 Lbs.</td>
</tr>
<tr>
<td>Annual Rye</td>
<td>0.40 Lbs.</td>
</tr>
<tr>
<td>Creeping Red Fescue</td>
<td>1.20 Lbs.</td>
</tr>
</tbody>
</table>

Rate of seeding application shall be 4 pounds PLS per 1000 square feet. The use of a brillion drill will be permitted. Broadcasting with hand raking seed into the soil and rolling will also be permitted.

Fertilizer shall be a starter fertilizer. Rate of fertilizer application shall be 4 pounds per 1000 square feet. Payment shall be incidental to other bid items.

DITCH SEEDING – Contractor shall seed and fertilize all disturbed areas after the topsoil is placed to the satisfaction of the Engineer. The seed shall be smooth brome grass or other approved grass at the rate of 20# live seed per acre. Fertilize with 18-46-0 at the rate of 150# per acre. Payment shall be incidental to other bid items.

CONCRETE PAVEMENT REMOVAL & REPLACEMENT – The surface of all concrete pavements shall be sawed with a concrete saw to a depth of a minimum of four inches before concrete is removed. The width of pavement removed shall be twelve inches (12”) wider than the trench excavation to provide a shoulder on each side. Where within two feet of existing joint, concrete shall be removed to the joint.
The Contractor shall place a six-inch (6") gravel base unless otherwise specified and replace the concrete pavement to the same thickness as the original pavement, with a minimum thickness of six inches (6"). The concrete shall be South Dakota Department of Transportation M-6 concrete and shall be finished the same as the existing pavement.

The cost of pavement removal, replacement, and sawing of the concrete shall be included in the unit price for concrete pavement removal and replacement. Contractor will be responsible for all costs of concrete pavement removal and replacement outside the limits as indicated in the plans unless approved by the City Engineer.

**ASPHALT REMOVAL & REPLACEMENT** – Where streets are asphalt surfaced, the Contractor shall cut the asphalt surfacing to a minimum depth of four inches by an approved method to a width of twelve inches (12") wider than the trench excavation.

On all excavations in asphalt surfaces without concrete base, there shall be a minimum of nine-inches (9") gravel base and a minimum of three-inch (3") asphalt mat or the thickness of the existing mat whichever is the greater.

All asphalt surfacing shall be replaced and compacted or rolled in accordance with SDDOT Class E asphalt concrete to 95% maximum Marshall density.

The cost of removing, replacing, cutting asphalt surfacing, and gravel base shall be included in the unit price for asphalt removal and replacement. Contractor will be responsible for asphalt removal and replacement for the area disturbed beyond the limits indicated in the plans unless approved by the City Engineer.

When asphalt concrete pavement removal & replacement are bid by the linear foot, measurement shall be center manhole to center manhole, or from connection with existing stub. Additional quantities necessary for the installation of manholes and connections to existing manholes or stubs shall be absorbed in the unit price bid; no additional payment will be made.

**PAVEMENT CUTTING** – All roadway surface cuts, asphalt or concrete, shall be in a straight line parallel to the existing curb and gutter or perpendicular to the centerline of the street. No jagged, skewed or irregular cuts will be allowed. All asphalt cuts shall be in an approved manner, and not ripped-out with the bucket. Such work lifts the remaining mat away from the base material and shall be cause for widening the street cut and increasing the amount of surfacing replaced at the Contractor's expense.

**PROTECTION AND RESTORATION OF PROPERTY PINS** – The Contractor shall protect from disturbance or damage all land monuments and property markers until the Engineer has witnessed or referenced their location and shall not move them until directed.

**7. USE AND REPAIR OF STREET**

Wherever any paved gutters, pavements, graveled highways, street crossings, or other improvements are interfered with or removed, they must be replaced by the Contractor and left in as good condition as previously. The Contractor shall also remove surplus material leaving the streets clean and in good order.

All street repairs and cleaning shall be promptly done as the work progresses. The Contractor shall not obstruct any street gutters but shall provide for the passage of surface water along the same at all times.

**LIMITATIONS OF OPERATIONS** – The Contractor shall conduct the Work in such a manner and in such sequence as will assure the least interference with the public. The Contractor shall have due regard to the location of detours and to the provisions for handling traffic. The Engineer may require the Contractor to finish a section of Work before Work is started on any additional sections if the opening of such section is essential to public convenience.

**8. MAINTENANCE**

**MAINTENANCE** – Maintenance shall constitute continuous and effective Work, prosecuted day by day, with equipment and forces to keep the Project site in satisfactory condition. Until final written acceptance of the project by the City, the Contractor shall have the charge and care thereof, and shall take every precaution against injury or damage to any part thereof by action of the elements or other cause, whether arising from the execution or from the non-execution of the Work.
In case of suspension of work for any cause, the Contractor shall (at the Contractor's expense) be responsible for the project and take precautions as may be necessary to prevent damage to the project, provide for normal drainage and shall erect necessary temporary structures, signs or other facilities. During such period of suspension of Work, the Contractor shall properly and continuously maintain in an acceptable growing condition living material in newly established plantings, seedings, and soddings furnished under this Contract, and protect new tree growth and other important vegetative growth against injury.

MAINTENANCE OF PUBLIC USE – Unless otherwise provided in the Special Provisions or on the Plans, the Project shall be kept open to public use by the Contractor. The Contractor shall keep the portion of the Project being used by the public in such condition that the public will be adequately accommodated. Accommodation of the public is not limited to but shall include providing flaggers in areas where the operation of construction equipment interferes with the movement of traffic and providing a roadway in a passable condition. The Contractor shall also provide and maintain in a safe condition temporary approaches or crossings and intersection with trails, roads, streets, businesses, parking lots, residences, garages and driveways.

When work begins on a roadbed, pavement structure, or underground utility, the Contractor shall be responsible for maintaining the entire project. This responsibility will continue until the Project is completed and accepted.

The Contractor shall bear the expense of maintaining public use over the Project undergoing improvement, constructing and maintaining approaches, crossings, intersections, and other features as may be necessary, without direct compensation.

Maintenance shall constitute continuous and effective Work, prosecuted day by day, with equipment and forces to keep the Project site in satisfactory condition.

If the Contractor is dilatory in completing the Work, the Engineer may order all or a portion of the project open to use. In such event, the Contractor shall not be relieved of liability and responsibility during the period the work is so opened before final acceptance. The Contractor shall conduct the remainder of construction operations to cause the least obstruction to traffic.

9. TRAFFIC CONTROL

BARRICADES AND WARNING SIGNS - The Contractor shall provide, erect, and maintain necessary barricades, suitable and sufficient lights, danger signals, signs and other traffic control devices as directed by the Engineer. The Contractor shall take all necessary precautions for the protection of the Work and safety of the public. Streets closed to traffic shall be protected by barricades. Obstructions shall be illuminated during hours of darkness. Warning signs shall be provided to control and direct traffic. The Contractor shall erect warning signs in advance of the project where operation may interfere with the use of the street by traffic, and at intermediate points where the Work crosses or coincides with an existing street. As a minimum, barricades, warning signs, lights, temporary signals and other protective devices must conform to the Manual on Uniform Traffic Control Devices for Streets and Highways issued by the United States Department of Transportation. Traffic Control shall be incidental to other items of the contract, unless a bid item for "Traffic Control" is provided in the contract.

10. ARCHAEOLOGICAL AND HISTORICAL SITES

The Contractor shall notify the Engineer of any archaeological or historical site that the Contractor might discover, or otherwise become aware of during the performance of Work at the Site. The Contractor shall suspend all Work at the Project Site (as directed by the Engineer) for a period not to exceed seventy two (72) hours to give the Archaeological Research Center and Department of Education and Cultural Affairs an opportunity to observe, investigate and otherwise inspect the Project Site.

The Contractor shall aid and assist in any salvaging or preservation program as directed by the Engineer. Any additional Work caused by compliance with requests for such assistance will be considered as extra Work outside the requirements of the Contract Documents and the Contractor will eligible for a Change Order.

11. LOAD RESTRICTIONS

The Contractor shall comply with all load restrictions as established by Laws and Regulations on streets and highways outside the limits of the Project. Within the project limits of the Project, the Contractor shall comply with the established
load restrictions and with special load restrictions imposed by the contract for the hauling of material and the movement of equipment over bridges and culverts and the course making up the pavement structure. Weight restrictions will not be imposed for the hauling of materials or movement of equipment on an earth subgrade, selected backfill, service gravel, or gravel surfacing. Nothing set forth in the foregoing shall relieve the Contractor of liability for damage resulting from the operation and movement of construction equipment.

12. CONTROL OF MATERIALS

SOURCE OF SUPPLY AND QUALITY REQUIREMENTS – The materials used on the Work shall conform to requirements of the Contract Documents. To expedite the inspection and testing of materials, the Contractor shall notify the Engineer of proposed sources of materials before delivery. At the option of the Engineer, materials may be approved at the source of supply before delivery is started. If it is found after trial those sources of supply for previously approved materials do not produce specified products; the Contractor shall furnish materials from other sources.

SAMPLES, TESTS, CITED SPECIFICATIONS – Materials, before incorporation in the Work, must be inspected, tested and approved for use by the Engineer. In lieu thereof, the Engineer may permit or require the Contractor to furnish certification for certain materials. Work in which unapproved materials are used shall be performed at the Contractor's risk and are subject to inspection, test, or rejection. Copies of tests will be furnished to the Contractor's representative when requested. Samples taken and tests made will be in accordance with the most recent standard or tentative standard methods of AASHTO, ASTM, and the "South Dakota Department of Transportation, Materials Manual-Sampling and Testing Procedures," which are current on the date of Invitation to Bid. Samples will be taken and tests made by a representative of the City and at City expense except as otherwise stipulated. Should a discrepancy be found to exist between AASHTO and ASTM sampling and testing procedures, those stipulated by AASHTO will prevail. Likewise, in case discrepancies are noted between AASHTO or ASTM and the aforementioned "Materials Manual", the procedures specified in the "Materials Manual" will prevail. Where the abbreviated citations "AASHTO" or ASTM followed by the appropriate serial numbers are used, they shall be construed to mean the test method or specification, either Standard or Approved Interim, which are in effect on the date of Invitation to Bid.

PLANT INSPECTION – The Engineer may undertake the inspection of materials at the source. In the event plant inspection is undertaken the following conditions shall be met:
A. The Engineer shall have the cooperation and assistance of the Contractor and the producer.
B. The Engineer shall have full entry at all times to such parts of the plant as may concern the manufacture or production of the materials being furnished.
C. Adequate safety measures shall be provided and maintained.

It is understood that the City reserves the right to retest materials which have been tested and accepted at the source of supply after the same have been delivered and to reject materials which do not meet the requirements of the specifications or those established for the specific project.

STORAGE OF MATERIALS – Materials shall be stored to assure the preservation of quality and fitness for the Work. Stored materials shall be located to facilitate prompt inspection. Approved portions of the Project Area may be used for storage purposes and for the placing of the Contractor's plant and equipment. Additional space required must be provided by the Contractor at his expense. Private property shall not be used for storage purposes without written permission of the owner or lessee. If requested, copies of such written permission shall be furnished to the Engineer. Storage sites shall be restored to their original condition by the Contractor at his expense.

HANDLING MATERIALS – Materials shall be handled in such manner as to preserve their quality and fitness for the work. Aggregates shall be transported from the storage site to the work in tight vehicles constructed as to prevent loss or segregation of materials after loading and measuring in order that there may be no inconsistencies in the quantities of materials intended for incorporation in the work as loaded, and the quantities as received at the place of operations.

UNACCEPTABLE MATERIALS – Materials not conforming to the requirements of the specifications shall be considered as unacceptable and will be rejected and shall be removed immediately from the site of the Project unless otherwise instructed by the Engineer. Rejected materials, the defects of which have been corrected, shall not be used unless approval has been given.

CITY-FURNISHED MATERIAL – The Contractor shall furnish all materials required to complete the Work, except those specified to be furnished by the City in the Plans or Special Provisions. Material furnished by the City will be delivered or made available to the Contractor at points specified in the Plans or Special Provisions. The Contractor will
be held responsible for material delivered. Deductions will be made from moneys due the Contractor to make good any shortages and deficiencies, for any cause whatsoever, for damage that may occur after such delivery, and demurrage charges. The cost of handling and placing materials after they are delivered to the Contractor shall be considered as included in the Contract Price for the item concerning which they are used.

CONSTRUCTION WASTE MATERIAL – Construction waste material shall include asphalt, gravel, base, clay, rock, broken concrete, and the like. The Contractor shall dispose of all construction waste material at a site furnished by the Contractor as approved by the Engineer. The Contractor will be required to contact the City Engineer before disposal of construction waste material. Construction waste material may not be disposed of within the City or State ROW. All costs incurred for the disposal of construction waste material shall be absorbed in the appropriate unit prices and no separate payment will be made.

CONSTRUCTION AND DEMOLITION (C&D) DEBRIS – C&D materials such as wood, metals, glass, plastic, and salvaged building components generated during the construction, renovation, and demolition of buildings, roads, and bridges must be disposed at a state permitted solid waste disposal facility if the Contractor disposes this material. The Department of Environment and Natural Resources, Waste Management Program can provide a list of permitted solid waste disposal facilities in the project area. Contact the Waste Management Program at (605)773-3153 for a list of permitted facilities or discuss proper disposal of construction and demolition debris.

13. CONSTRUCTION STAKING

The Engineer will set the necessary grade stakes. The Contractor shall notify the Engineer at least twenty-four (24) hours before need for such stakes. For structures, the Engineer will set stakes for elevation and such other necessary stakes as will establish definitely the location, elevation, and alignment of the structure. The Contractor shall be responsible for the preservation of stakes and marks. If construction stakes or marks have been carelessly or willfully destroyed or disturbed by the Contractor, the cost of replacing them will be charged to the Contractor.

14. INSPECTION AND TESTING

GENERAL – Materials and details of the Work shall be subject to inspection by the Engineer. The Engineer shall be allowed access to the Work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection. The Contractor shall furnish such personnel, facilities, equipment, tools, and materials as are necessary to make whatever tests and inspection that are deemed necessary by the Engineer.

DUTIES OF THE INSPECTOR - Inspectors are authorized to inspect any Work and materials furnished. Inspection may extend to any part of the Work, preparation, fabrication or manufacture of the materials to be used. The Inspector is not authorized to alter or waive the requirements of the Contract Documents. The Inspector is not authorized to issue instructions contrary to the Drawings or Specifications, or to act in a supervisory capacity for the Contractor. The Inspector will have the authority to reject Work or materials until any questions at issue can be referred to and decided by the Engineer.

OTHER INSPECTIONS – When a unit of government other than the City, political subdivision, railroad corporation, or the like is to pay a portion of the Project costs, its respective representatives shall have the right to inspect the Work. Such inspections shall not make such other entity a party to the Contract and shall not interfere with the rights of either party thereunder.

15. MEASUREMENT OF QUANTITIES – Work completed under the contract will be measured by the Engineer according to United States standard measure. The method of measurement and computation to be used in determination of quantities of material furnished and of Work performed under the contract will be those methods generally recognized as conforming to good engineering practice.

AREAS – Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and deductions will not be made for individual fixtures having an area of nine (9) square feet or less. Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the plans or ordered in writing by the Engineer.

LINEAR FOOT – Items which are measured by the linear foot, such a water main, sewer main, guardrail, underdrains, etc., will be measured parallel to the base or foundation upon which such structures are placed, except as otherwise provided in these specifications.
VOLUME – In computing volumes of excavation, the average end area method or other mutually acceptable methods will be used. Materials to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this purpose may be of any size or type acceptable to the Engineer, provided the body is of such shape that the volume may be readily and accurately determined.

WEIGHT and SCALES – The term "ton" will mean a short ton consisting of two thousand (2,000) pounds. Materials that are measured or proportioned by weight shall be weighed on accurate, approved scales furnished by the Contractor at locations designated by the Engineer. The use of commercial scales may be permitted provided they are satisfactory to the Engineer and all charges for such use are paid by the Contractor. Except as provided elsewhere in the specifications, scales shall be accurate within one (1) percent at any point throughout the range of use of the scale and sensitive to the weight indicated by twice the smallest graduation of the scale. The Contractor shall provide, and be responsible for, the verification by the State Scale Inspector, or by other feasible means as the Engineer may order, of scales and measures which the Contractor is to operate or use in connection with the work. Platform scales shall be of adequate length and capacity to permit weighing the entire hauling unit with one (1) placement. In the case of tractor-trailer combinations, this will mean placement in one (1) operation of the entire unit inclusive of the front axle of the tractor. It will be permissible to weigh the primary hauling unit and the auxiliary hauling ("pup") unit separately without uncoupling, provided the scale approach ramps are level for a sufficient distance and the auxiliary hauling unit coupling does not transfer significant weight to the primary hauling unit. Trucks used to haul material being paid for by weight shall be weighed empty at such times as the Engineer directs, and each truck shall bear a plainly legible identification mark.

When requested by the Contractor and approved by the Engineer in writing, material specified to be measured by the cubic yard or gallon may be weighed and such weights will be converted to cubic yards or gallons for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the Engineer and shall be agreed to by the Contractor before such method of measurement of pay quantities is used.

LUMP SUM – The term "lump sum" when used as an item of payment will mean complete payment for the work described in the contract. When a complete structure or structural unit (in effect, "lump sum" work) is specified as the unit of measurement, the unit will be construed to include necessary fittings and accessories.

16. GUARANTEE

GENERAL – The Contractor shall guarantee all the Work performed on the Project including all the materials used. All materials and equipment furnished under this Contract shall be new unless otherwise specified. All Work shall be good quality, free from defects and faults. Any defects in the completed Work, or any part of it, or any failure of the Work to fully perform or endure the service for which it was intended, which in the opinion of the Engineer, are attributable to the use of materials, skill, or workmanship not in compliance with the Contract Documents will be rejected. The Contractor shall at its own expense and in such manner as the Engineer shall direct, repair or take up and reconstruct any such defective Work in full compliance with the Contract Documents for the guarantee period of not less than one year after final payment.
This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

BID FORM
FOR CONSTRUCTION CONTRACTS

Prepared by

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

Issued and Published Jointly by

ACEC
AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

National Society of Professional Engineers®
BID FORM

WASTEWATER TREATMENT FACILITIES ALKALINITY FEED ADDITION

City of Watertown Project No. 1419
HDR Project No. 135-230216-003
<table>
<thead>
<tr>
<th>ARTICLE</th>
<th>Page</th>
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<tbody>
<tr>
<td>1 – Bid Recipient</td>
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<tr>
<td>2 – Bidder’s Acknowledgements</td>
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<td>3 – Bidder’s Representations</td>
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<td>4 – Bidder’s Certification</td>
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<td>5 – Basis of Bid</td>
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<td>6 – Time of Completion</td>
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<tr>
<td>7 – Attachments to this Bid</td>
<td>2</td>
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<tr>
<td>8 – Bid Submittal</td>
<td>3</td>
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</table>
ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

City of Watertown - Finance Department
23 2nd Street NE - P.O. Box 910
Watertown, SD 57201-0910

See City of Watertown Standard Contract Documents Chapter 1, Paragraph 8 for Bidding Requirements.

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS

2.01 See City of Watertown Standard Contract Documents, Chapter 1, Instructions to Bidders.

ARTICLE 3 – BIDDER’S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

<table>
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<tr>
<th>Addendum No.</th>
<th>Addendum, Date</th>
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B. See City of Watertown Standard Contract Documents.

ARTICLE 4 – BIDDER’S CERTIFICATION

4.01 Bidder certifies that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. See City of Watertown Standard Contract Documents.
ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following lump sum price:

| Lump Sum Bid Price | $ |

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with the City of Watertown Standard Contract Documents.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages as described in the City of Watertown Standard Contract Documents.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are submitted with and made a condition of this Bid:
   A. Required Bid security;
   B. See City of Watertown Standard Contract Documents
ARTICLE 8 – BID SUBMITTAL

BIDDER: [Indicate correct name of bidding entity]

By: 
[Signature]
[Printed name]

(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:
[Signature]
[Printed name]

Title:

Submittal Date:

Address for giving notices:

Telephone Number:

Fax Number:

Contact Name and e-mail address:

Bidder’s License No.: (where applicable)
DIVISION 01
GENERAL REQUIREMENTS
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for:
      a. Preconstruction Conference.
      b. Contractor's Superintendent's Field Office.
      c. Engineer's Field Office.
      d. Drawings and Contract Documents for Contractor use.
      e. Testing.
      f. Schedule of Values.
      g. Project meetings.
      h. Special considerations related to adjacent properties and facilities.
      i. Historical and archaeological finds.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.

1.2 PRECONSTRUCTION CONFERENCE

A. A preconstruction conference shall be held at the Watertown Wastewater Treatment Facility
   after award of Contract.
   1. Engineer will notify the Contractor as to the date and time of the conference two (2) weeks
      in advance of the proposed date.
   2. Contractor's Project Manager and Project Superintendent and Contractor's Subcontractor
      Representatives shall attend.

1.3 CONTRACTOR'S SUPERINTENDENT'S FIELD OFFICE

A. Establish at site of Project.

B. Equipment: Telephone, telecopy, mailing address, and sanitary facilities.

C. Ensure attendance at this office during the normal working day.

D. At this office, maintain complete field file of Shop Drawings, posted Contract Drawings and
   Specifications, and other files of field operations including provisions for maintaining "As
   Recorded Drawings."

E. Remove field office from site upon acceptance of the entire work by the Owner.

1.4 ENGINEER'S FIELD OFFICE

A. Engineer's field office to be shared with Contractor's field office.

B. General construction:
   1. One private trailer office area. Door shall be lockable. Provide key to Engineer.

C. Electrical system:
   1. Room shall have at least six 110 V duplex electrical convenience outlets.

D. Heating and air-conditioning:
   1. Individual room unit is acceptable.
E. Lighting system:
   1. Fluorescent type producing 100 footcandles at desk top height.
   2. Ample ceiling fixtures provided to ensure adequate lighting throughout.

F. Furnishings:
   1. One (1) all-in-one color printer-copier-scanner capable of copying and printing 11x17 IN sheets.
   2. One desk 36 x 72 IN long with locking lap drawer.
   3. One plan table 39 x 72 x 36 IN wide, with one locking equipment drawer.
   4. Two four-drawer legal size filing cabinets.
   5. One cushioned swivel arm chair.
   6. Two conference chairs.
   7. One bookcase, composed of three shelves 36 IN long and 12 IN wide. The unit shall be a minimum of 3 FT high.
   8. One standard size waste paper basket.
   9. One Emerson Model OR300A, 2.7 CF refrigerator or equal.
  10. One Bottled Water Mini Cooler with 3 or 5 GAL water bottles.
  11. One 60 sheet capacity stapler with staples.

G. Maintenance:
   1. Contractor shall provide all maintenance and upkeep of trailer and equipment including 8-1/2 x 11 and 11 x 17 copy paper and printer ink cartridges. Equipment breakdowns shall be repaired promptly by Contractor.
   2. Janitorial service:
      a. Weekly:
         1) Floor sweeping using dust suppressing compound.
         2) Wet mopping with floor detergent.
      b. As required:
         1) Replenishment of bottled water station.
   3. Pay all utilities costs.
   4. Maintain at least until acceptance of the entire work by the Owner or until otherwise suspended by the Engineer.

H. Remove field office from site upon acceptance of the entire work by the Owner.

I. Maintain conditions of access road to site such that access is not hindered as the result of construction related deterioration.

1.5 DRAWINGS AND CONTRACT DOCUMENTS FOR CONTRACTOR USE

A. Refer to General Conditions.
B. Contractor shall pick up all "no-charge" documents within 10 days from date of Notice to Proceed.
C. Additional documents after "no-charge" documents will be furnished to Contractor at cost.

1.6 TESTING

A. Payment for Soil, Concrete and Other Testing:
   1. Soils and concrete testing:
      a. The Owner will pay for "Passing" soils and "Passing" concrete tests on the Project.
      b. Costs of corrective action, costs of "Failing" soils and concrete tests, and cost of testing associated with establishment of mix design are the sole responsibility of the Contractor.
   2. Other testing: Required testing, testing procedures, reports, certificates, and costs associated with all phases of securing required satisfactory test information which may be required by individual Specification Sections or Drawings are the full responsibility of the Contractor.
17. **SCHEDULE OF VALUES**

A. Where a Contract is awarded on a lump sum basis, the Contractor shall file with the Engineer a balanced price segregation of the lump sum bid into items similar to the various subdivisions of the general and detailed specifications, the sum of which shall equal the lump sum bid.

1. The cost of various materials shall be furnished upon request of the Engineer, and such data will then be used as a basis for making progress estimates.
2. Breakdown costs, itemized by Specification Section and trade, and distribute cost to individual applicable units and structures.
3. Where structures, units, equipment or other components are identified by a specific series or, identification number, utilize said designation throughout cost breakdown.
4. Provide detailed breakdown for individual yard piping or conduit runs and identify approximate quantities involved to satisfaction of the Engineer.
5. Provide separate breakdown for change order items requested.
6. Provide an additional breakdown sheet, equivalent to EJCDC document C620, Page 3 of 3, showing the tabulation format for stored materials.
7. Submit this sheet each month with Contractor's pay request breakdown.
8. The detail and format of cost breakdown and stored materials tabulation sheet shall be fully approved by Engineer.

B. A reasonable allocation of the Contract Price to the component parts of the Work will be approved if component parts of the Work have values assigned to them that are well-balanced with respect to relative values for similar work established by published estimating guides.

1. Unless otherwise agreed to at the Preconstruction Conference, Means Estimator Guide or other similar nationally recognized estimating guide shall be used for resolving differences between Engineer's and Contractor's opinions of allocation of values.
2. Consent of Surety: If Contractor and Engineer cannot mutually agree on a Schedule of Values, Engineer will approve a Schedule of Values approved by the Surety providing the Performance Bond.

C. Contractor's costs shall not govern the allocation of values when application of Contractor's costs to a component part of the Work results in any other component part or combination of component parts being under-valued in relation to conventional estimating guides.

D. Schedule of Values shall be agreed upon prior to first Application for Payment.

18. **PROJECT MEETINGS**

A. Construction Meetings:

1. The Engineer will conduct construction meetings involving:
   a. Contractor's project manager.
   b. Contractor's project superintendent.
   c. Owner's designated representative(s).
   d. Engineer's designated representative(s).
   e. Contractor's subcontractors as appropriate to the Work in progress.
   f. Owner's Construction Quality Control Consultant.

2. Meetings will be conducted every two (2) weeks.

3. The Engineer will take meeting minutes and submit copies of meeting minutes to participants and designated recipients identified at the Preconstruction Conference.

   a. Corrections, additions or deletions to the minutes shall be noted and addressed at the following meeting.

4. The Engineer will schedule meetings for most convenient time frame.

5. The Engineer will have available at each meeting full chronological files of all previous meeting minutes.

6. The Contractor shall have available at each meeting up-to-date record drawings.
B. Pre-Installation Conferences:
   1. Coordinate and schedule with Resident Project Representative and Engineer for each material, product or system specified.
      a. Conferences to be held prior to initiating installation, but not more than two (2) weeks before scheduled initiation of installation.
      b. Conferences may be combined if installation schedule of multiple components occurs within the same two (2) week interval.
   2. Contractor's Superintendent and individual who will actually act as foreman of the installation crew (installer), if other than the Superintendent, shall attend.

1.9 SPECIAL CONSIDERATIONS RELATED TO ADJACENT PROPERTIES AND FACILITIES

A. Contractor shall be responsible for negotiations of any waivers or alternate arrangements required to enable transportation of materials to the site.

B. Maintain conditions of access road to site such that access is not hindered as the result of construction related deterioration.
   1. Provide daily sweeping of hard-surface roadways to remove soils tracked onto roadway.

1.10 HISTORICAL AND ARCHAEOLOGICAL

A. If during the course of construction, evidence of deposits of historical or archeological interest is found, the Contractor shall cease operations affecting the find and shall notify Owner.
   1. No further disturbance of the deposits shall ensue until the Contractor has been notified by Owner that Contractor may proceed.
   2. Owner will issue a notice to proceed after appropriate authorities have surveyed the find and made a determination to Owner.
   3. Compensation to the Contractor, if any, for lost time or changes in construction resulting from the find, shall be determined in accordance with changed or extra work provisions of the Contract Documents.
   4. The site has been previously investigated and has no known history of historical or archaeological finds.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION
SECTION 01340
SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mechanics and administration of the submittal process for:
      a. Shop Drawings.
      b. Samples.
      c. Informational submittals.
   2. General content requirements for Shop Drawings.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   4. Specification Sections in Division 02 through Division 16 identifying required submittals.

1.2 DEFINITIONS

A. Shop Drawings:
   1. See General Conditions.
   2. Product data and samples are Shop Drawing information.

B. Informational Submittals:
   1. Submittals other than Shop Drawings and samples required by the Contract Documents that do not require review and/or approval by the Engineer.
   2. Representative types of informational submittal items include but are not limited to:
      a. HVAC test and balance reports.
      b. Installed equipment and systems performance test reports.
      c. Manufacturer's installation certification letters.
      d. Instrumentation and control commissioning reports.
      e. Warranties.
      f. Service agreements.
      g. Construction photographs.
      h. Survey data.
      i. Health and safety plans.
      j. Work plans.
      k. Delegated designs per performance specification requirements
   3. For-Information-Only submittals upon which the Engineer is not expected to conduct review or take responsive action may be so identified in the Contract Documents.

1.3 SUBMITTAL SCHEDULE

A. Schedule of Shop Drawings:
   1. Submitted and approved within 10 days of receipt of Notice to Proceed.
   2. Account for multiple transmittals under any Specification Section where partial submittals will be transmitted, e.g. rebar shop drawings.
   3. Submittal and approval prior to 50 percent completion.

B. Informational Submittals:
   1. Reports and installation certifications submitted within five (5) working days of conducting testing or examination.
C. The submittal schedule shall include the following columns as a minimum:

<table>
<thead>
<tr>
<th>Submittal Section</th>
<th>Submittal Description</th>
<th>Planned Submittal Date</th>
<th>Submittal Need Date</th>
<th>Actual Submittal Date</th>
<th>Actual Return Date</th>
<th>Disposition</th>
</tr>
</thead>
</table>

1.4 PREPARATION OF SUBMITTALS

A. Legibility:
1. All submittals and all pages of all copies of a submittal shall be completely legible.
2. Submittals which, in the Engineer’s sole opinion, are illegible will be returned without review.

B. Shop Drawings, Product Data, and Samples:
1. Shop Drawings shall be submitted electronically to Engineer.
   a. Each shop drawing shall be converted into a Portable Document Format (PDF) document and submitted to the Engineer by submitting to HDR’s Project Tracker System.
   b. Protocol for handling shop drawing submittals will be discussed in greater detail during the Preconstruction Meeting.
   c. Do not password protect and/or lock the PDF document.
   d. Create one (1) PDF document (.PDF file) for each shop drawing submittal.
      1) The entire submittal shall be created electronically as a single PDF file.
      2) Drawings or other graphics must be converted to PDF format and made part of the document.
         a) Scanning is to be used only where actual file conversion is not possible.
      3) Rotate pages that must be viewed in landscape to the appropriate position for easy reading.
2. Scope of any submittal and letter of transmittal:
   a. Limited to one (1) Specification Section.
   b. Do not submit under any Specification Section entitled (in part) "Basic Requirements" unless the product or material submitted is specified, in total, in a "Basic Requirements" Specification Section.
3. Numbering letter of transmittal:
   a. Use the Specification Section number followed by a series number ("-xx" and beginning with "01"); increase the series number sequentially with each additional transmittal for that Specification Section.
4. Describing transmittal contents:
   a. Provide listing of each component or item in submittal capable of receiving an independent review action.
   b. Identify for each item:
      1) Manufacturer and Manufacturer's Drawing or data number.
      2) Contract Document tag number(s).
      3) Unique page numbers for each page of each separate item.
   c. When submitting "or-equal" items that are not the products of named manufacturers, include the words "or-equal" in the item description.
5. Contractor certification of review and approval:
   a. Contractor's review and approval certification stamp shall be applied either to the letter of transmittal or a separate sheet preceding each independent item in the submittal.
      1) Stamp may be either a wet ink stamp or electronically embedded.
      2) Clearly identify the person who reviewed the submittal and the date it was reviewed.
3) Shop Drawing submittal stamp shall read "(Contractor's Name) has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval as stipulated in the General Conditions."

b. Submittals containing multiple independent items shall be prepared with each item listed on the letter of transmittal or on an index sheet for all items listing the discrete page numbers for each page of each item, which shall be stamped with the Contractor's review and approval stamp.
   1) Each independent item shall have a cover sheet with the transmittal number and item number recorded.
      a) Provide clear space of 3 IN SQ for Engineer stamping.
   2) Individual pages or sheets of independent items shall be numbered in a manner that permits the entire contents of a particular item to be readily recognized and associated with Contractor's certification.

6. Resubmittals:
   a. Number with original Specification Section and series number with a suffix letter starting with "A" on a (new) duplicate transmittal form.
   b. Do not increase the scope of any prior transmittal.
   c. Account for all components of prior transmittal.
      1) If items in prior transmittal received "A" or "B" Action code, list them and indicate "A" or "B" as appropriate.
         a) Do not include submittal information for items listed with prior "A" or "B" action in resubmittal.
      2) Indicate "Outstanding-To Be Resubmitted At a Later Date" for any prior "C" or "D" Action item not included in resubmittal.
         a) Obtain Engineer's approval to exclude items.

7. Contractor shall not use red color for marks on transmittals.
   a. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible.
   b. Engineer will use red marks or enclose marks in a cloud.

8. Transmittal contents:
   a. Coordinate and identify Shop Drawing contents so that all items can be easily verified by the Engineer.
   b. Provide submittal information or marks defining specific equipment or materials utilized on the Project.
      1) Generalized product information, not clearly defining specific equipment or materials to be provided, will be rejected.
   c. Identify equipment or material project application, tag number, Drawing detail reference, weight, and other Project specific information.
   d. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
   e. Do not modify the manufacturer's documentation or data except as specified herein.
   f. Submit items such as equipment brochures, cuts of fixtures, product data sheets or catalog sheets on 8-1/2 x 11 IN pages.
      1) Indicate exact item or model and all options proposed.
   g. When a Shop Drawing submittal is called for in any Specification Section, include as appropriate, scaled details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout Drawings, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data in addition to information specifically stipulated in the Specification Section.
      1) Arrange data and performance information in format similar to that provided in Contract Documents.
      2) Provide, at minimum, the detail specified in the Contract Documents.
h. If proposed equipment or materials deviate from the Contract Drawings or
Specifications in any way, clearly note the deviation and justify the said deviation in
detail in a separate letter immediately following transmittal sheet. Any deviation from
plans or specifications not depicted in the submittal or included but not clearly noted by
the Contractor may not have been reviewed. Review by the Engineer shall not serve to
relieve the Contractor of the contractual responsibility for any error or deviation from
contract requirements.

9. Samples:
   a. Identification:
      1) Identify sample as to transmittal number, manufacturer, item, use, type, project
designation, tag number, Specification Section or Drawing detail reference, color,
range, texture, finish and other pertinent data.
      2) If identifying information cannot be marked directly on sample without defacing or
adversely altering samples, provide a durable tag with identifying information
securely attached to the sample.
   b. Include application specific brochures, and installation instructions.
   c. Provide Contractor's review and approval certification stamp or Contractor's Submittal
Certification form as indication of Contractor's checking and verification of dimensions
and coordination with interrelated work.
   d. Resubmit revised samples of rejected items.

C. Informational Submittals:
   1. Prepare in the format and detail specified in Specification requiring the informational
submittal.

1.5 TRANSMITTAL OF SUBMITTALS

A. Samples:
   1. Transmit all samples to:

   HDR
   6300 S. Old Village Place, Suite 100
   Sioux Falls, SD, 57108
   Attn: Al Erickson
   2. Utilize two (2) copies of attached Exhibit A to transmit all Shop Drawings and samples.
   3. All submittals must be from Contractor.
      a. Submittals will not be received from or returned to subcontractors.

B. Electronic Transmission of Submittals:
   1. Transmittals shall be made electronically.
      a. Use HDR's Project Tracker Collaboration System (PTCS).
      b. Protocols and processes will be determined at the Pre-Construction Conference.
   2. Scan all transmittals into Adobe Acrobat Portable Document Format (PDF), latest version,
      with printing enabled.
      a. Do not password protect or lock the PDF document.
      b. Rotate sheets that are normally viewed in landscape mode so that when the PDF file is
opened the sheet is in the appropriate position for viewing.
   3. Required signatures may be applied prior to scanning for transmittal.

1.6 ENGINEER'S REVIEW ACTION

A. Shop Drawings and Samples:
   1. Items within transmittals will be reviewed for overall design intent and will receive one (1)
of the following actions:
      a. A - FURNISH AS SUBMITTED.
      b. B - FURNISH AS NOTED (BY ENGINEER).
      c. C - REVISE AND RESUBMIT.
d. D - REJECTED.

e. E - ENGINEER'S REVIEW NOT REQUIRED.

2. Submittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp.

a. Submittals not stamped by the Contractor or stamped with a stamp containing language other than that specified herein will not be reviewed for technical content and will be returned rejected.

3. In relying on the representation on the Contractor’s review and approval stamp, Owner and Engineer reserve the right to review and process poorly organized and poorly described submittals as follows:

a. Submittals transmitted with a description identifying a single item and found to contain multiple independent items:
   1) Review and approval will be limited to the single item described on the transmittal letter.
   2) Other items identified in the submittal will:
      a) Not be logged as received by the Engineer.
      b) Be removed from the submittal package and returned without review and comment to the Contractor for coordination, description and stamping.
      c) Be submitted by the Contractor as a new series number, not as a re-submittal number.

b. Engineer, at Engineer’s discretion, may revise the transmittal letter item list and descriptions, and conduct review.
   1) Unless Contractor notifies Engineer in writing that the Engineer’s revision of the transmittal letter item list and descriptions was in error, Contractor’s review and approval stamp will be deemed to have applied to the entire contents of the submittal package.

4. Submittals returned with Action "A" or "B" are considered ready for fabrication and installation.

a. If for any reason a submittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal.

b. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "A" or "B" Action that are superseded by a resubmittal.

5. Submittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:

a. The portion of the submittal given "C" or "D" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference).
   1) One (1) copy or the one (1) transparency of the "C" or "D" Drawings will be marked up and returned to the Contractor.
      a) Correct and resubmit items so marked.
   b. Items marked "A" or "B" will be fully distributed.

b. If a portion of the items or system proposed are acceptable, however, the major part of the individual Drawings or documents are incomplete or require revision, the entire submittal may be given "C" or "D" Action.
   1) This is at the sole discretion of the Engineer.
   2) In this case, some Drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package."
   3) Distribution to the Owner and field will not be made (unless previously agreed to otherwise).

6. Failure to include any specific information specified under the submittal paragraphs of the Specifications will result in the submittal being returned to the Contractor with "C" or "D" Action.
7. Calculations required in individual Specification Sections will be received for information purposes only, as evidence calculations have been stamped by the professional as defined in the specifications and for limited purpose of checking conformance with given performance and design criteria. The Engineer is not responsible for checking the accuracy of the calculations and the calculations will be returned stamped "E. Engineer's Review Not Required" to acknowledge receipt.

8. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer’s time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer’s charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.

9. Transmittals of submittals which the Engineer considers as "Not Required" submittal information, which is supplemental to but not essential to prior submitted information, or items of information in a transmittal which have been reviewed and received "A" or "B" action in a prior submittal, will be returned with action "E. Engineer's Review Not Required."

10. Samples may be retained for comparison purposes.
   a. Remove samples when directed.
   b. Include in bid all costs of furnishing and removing samples.

11. Approved samples submitted or constructed, constitute criteria for judging completed work.
   a. Finished work or items not equal to samples will be rejected.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION
**EXHIBIT A**

**Shop Drawing Transmittal**

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<tr>
<th>Item No.</th>
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<th>Description</th>
<th>Manufacturer</th>
<th>Mfr/Vendor Dwg or Data No.</th>
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Remarks:

* The Action designated above is in accordance with the following legend:

A - Furnish as Submitted

B - Furnish as Noted

C - Revise and Submit
1. Not enough information for review.
2. No reproducibles submitted.
3. Copies illegible.
5. Wrong sequence number.
6. Wrong resubmittal number.
7. Wrong spec. section.
8. Wrong form used.
9. See comments.

D - Rejected

E - Engineer’s review not required
1. Submittal not required.
2. Supplemental Information. Submittal retained for informational purposes only.
3. Information reviewed and approved on prior submittal.
4. See comments.
5. Delegated Design - Submittal received as requested by the Contract Documents. The Engineer did not review the engineering or technical content of the submittal.

Engineer’s review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Any deviation from plans or specifications not depicted in the submittal or included but not clearly noted by the Contractor may not have been reviewed. Review by the Engineer shall not serve to relieve the Contractor of the contractual responsibility for any error or deviation from contract requirements.

Comments:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

By Date

Distribution: Contractor | File | Field | Owner | Other |
SECTION 01342
OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Administration of the submittal process for Operation and Maintenance Manuals.
   2. Content requirements for Operation and Maintenance Manuals.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. General submittal requirements are specified in Specification Section 01340 - Submittals.
   4. Sections in Division 02 through Division 16 identifying required Operation and Maintenance Manual submittals.

1.2 DEFINITIONS
A. Equipment Operation and Maintenance Manuals:
   1. Contain the technical information required for proper installation, operation and maintenance of process, electrical and mechanical equipment and systems.
B. Building Materials and Finishes Operation and Maintenance Manuals:
   1. Contain the information required for proper installation and maintenance of building materials and finishes.

1.3 SUBMITTALS
A. List of all the Operation and Maintenance Manuals required by the Contract as identified in Division 02 through Division 16.
B. Operation and Maintenance Manuals:
   1. Draft and final electronic copies.
   2. Final paper copies: Three (3).

1.4 SUBMITTAL SCHEDULE
A. List of Required Operation and Maintenance Manuals:
   1. Submit list with Specification Section number and title within 90 days after Notice to Proceed.
B. Draft Operation and Maintenance Manuals:
   1. Submit approvable draft manuals in electronic format (PDF) within 30 days following approval of the respective Shop Drawing.
      a. Include placeholders or fly sheet pages where information is not final or is missing from the draft manual.
   2. All Draft Operation and Maintenance Manuals shall be received by no later than 50 percent project completion.
C. Final Operation and Maintenance Manuals:
   1. Final approval of Operation and Maintenance Manuals in electronic format (PDF) must be obtained 45 days prior to equipment start-up.
   2. Provide paper copies and CD-ROMs of approved final Operation and Maintenance Manuals in electronic format (PDF), a minimum of 30 days prior to equipment start-up.
3. Issue addenda to Final Approved Operation and Maintenance Manual to include:
   a. Equipment data that requires collection after start-up, for example but not limited to
      HVAC balancing reports, electrical switchgear, automatic transfer switch and circuit
      breaker settings.
   b. Equipment field testing data.
   c. Equipment start-up reports.

1.5 PREPARATION OF SUBMITTALS

A. General:
   1. All pages of the Operation and Maintenance Manual submittal shall be legible.
      a. Submittals which, in the Engineer’s sole opinion, are illegible will be rejected without
         review.
   2. Identify each equipment item in a manner consistent with names and identification numbers
      used in the Contract Documents, not the manufacturer’s catalog numbers.
   3. Neatly type any data not furnished in printed form.
   4. Operation and Maintenance Manuals are provided for Owner's use, to be reproduced and
      distributed as training and reference materials within Owner's organization.
      a. This requirement is:
         1) Applicable to both paper copy and electronic files.
         2) Applicable to materials containing copyright notice as well as those with no
            copyright notice.
   5. Notify supplier and/or manufacturer of the intended use of Operations and Maintenance
      Manuals provided under the Contract.

B. Operation and Maintenance Manual Format and Delivery:
   1. Draft electronic submittals:
      b. Create one (1) PDF file for each equipment Operation and Maintenance Manual.
      c. Do not password protect or lock the PDF document.
      d. Drawings or other graphics must be converted to PDF file format from the original
         drawing file format and made part of the PDF document.
      e. Scanning of drawings is to be used only where actual file conversion is not possible and
         drawings must be scanned at a resolution of 300 dpi or greater.
      f. Rotate sheets that are normally viewed in landscape mode so that when the PDF file is
         opened the sheet is in the appropriate position for viewing.
      g. Create bookmarks in the bookmarks panel for the Operation and Maintenance Manual
         cover, the Table of Contents and each major section of the Table of Contents.
      h. Using Adobe Acrobat Standard or Adobe Acrobat Professional, set the PDF document
         properties, initial view as follows:
            1) Select File ➔ Properties ➔ Initial View.
            2) Select the Navigation tab: Bookmarks Panel and Page.
            3) Select the Page layout: Single Page.
            4) Select the Magnification: Fit Page.
            5) Select Open to page: 1.
            6) Set the file to open to the cover page of the manual with bookmarks to the left, and
               the first bookmark linked to the cover page.
      i. Set the PDF file "Fast Web View" option to open the first several pages of the
         document while the rest of the document continues to load.
         1) To do this:
            a) Select Edit ➔ Preferences ➔ Documents ➔ Save Settings.
            b) Check the Save As optimizes for Fast Web View box.
      j. PDF file naming convention:
         1) Use the Specification Section number, the manufacturer’s name and the equipment
            description, separated by underscores.
         2) Example: 11083_Sanitaire_Coarse_Bubble_Diffusers.pdf.
         3) Do not put spaces in the file name.
2. Final electronic submittals:
   a. Submit two (2) copies in PDF file format on two (2) CD-ROM discs, each secured in a jewel case.
   b. CD-ROM Labeling:
      1) Provide the following printed labeling on all CD-ROM discs:
         a) Project name.
         b) Specification Section.
         c) Equipment names and summary of tag(s) covered.
         d) Manufacturer name.
         e) Date (month, year).
   c. CD-ROM Jewel Case Holder:
      1) Insert jewel cases containing labeled CD-ROM discs in three-ring binder holder (C-Line Products, www.c-lineproducts.com stock number CLI-61968 or equivalent) at the front of each final paper copy.

3. Final paper copy submittals:
   a. Quantity: Provide three (3) copies.
   b. Paper: 8.5 x 11 IN or 11 x 17 IN bright white, 20 pound paper with standard three-hole punching.
   c. 3-Ring Binder:
      1) Provide D-ring binder with clear vinyl sleeves (i.e. view binder) on front and spine.
      2) Insert binder title sheet with the following information under the front and spine sleeves:
         a) Project name.
         b) Specification Section.
         c) Equipment names and summary of tag(s) covered.
         d) Manufacturer name.
         e) Date (month, year).
      3) Provide plastic sheet lifters prior to first page and following last page.
   d. Drawings:
      1) Provide all drawings at 11 x 17 IN size, triple folded and three-hole punched for insertion into manual.
      2) Where reduction is not practical to ensure readability, fold larger drawings separately and place in three-hole punched vinyl envelopes inserted into the binder.
      3) Identify vinyl envelopes with drawing numbers.
   e. Use plastic coated dividers to tab each section of each manual in accordance with the Table of Contents.

C. Equipment Operation and Maintenance Manual Content:
   1. Provide a cover page as the first page of each manual with the following information:
      a. Manufacturer(s) Name and Contact Information.
      b. Vendor’s Name and Contact Information.
      c. Date (month, year).
      d. Project Owner and Project Name.
      e. Specification Section.
      f. Project Equipment Tag Numbers.
      g. Model Numbers.
      h. Engineer’s Name.
      i. Contractor’s Name.
   2. Provide a Table of Contents for each manual.
   3. Provide Equipment Record sheets as follows:
      a. Printed copies of the Equipment Record (Exhibits B1, B2 and B3), as the first tab following the Table of Contents.
      b. Exhibits B1-B3 are available as Fillable PDF Form documents from the Engineer.
      c. Each section of the Equipment Record must be completed in detail; simply referencing the related equipment Operation and Maintenance Manual sections for nameplate, maintenance, spare parts or lubricant information is not acceptable.
d. For equipment involving separate components (for example, a motor and gearbox), a fully completed Equipment Record is required for each component.

e. Submittals that do not include the Equipment Record(s) will be rejected without further content review.

4. Provide a printed copy of the Manufacturer’s Field Services report as required by Specification Section 01650 following the Equipment Record sheets.

5. Provide the following detailed information, as applicable:
   a. Use equipment tag numbers from the Contract Documents to identify equipment and system components.
   b. Equipment function, normal and limiting operating characteristics.
   c. Instructions for assembly, disassembly, installation, alignment, adjustment, and inspection.
   d. Operating instructions for start-up, normal operation, control, shutdown, and emergency conditions.
   e. Lubrication and maintenance instructions.
   f. Troubleshooting guide.
   g. Mark each sheet to clearly identify specific products and component parts and data applicable to the installation for the Project; delete or cross out information that does not specifically apply to the Project.
   h. Parts lists:
      1) A parts list and identification number of each component part of the equipment.
      2) Exploded view or plan and section views of the equipment with a detailed parts callout matching the parts list.
      3) A list of recommended spare parts.
      4) List of spare parts provided as specified in the associated Specification Section.
      5) A list of any special storage precautions which may be required for all spare parts.
   i. General arrangement, cross-section, and assembly drawings.
   j. Electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, and interconnection diagrams.
   k. Test data and performance curves.
   l. As-constructed fabrication or layout drawings and wiring diagrams.
   m. Copy of the equipment manufacturer’s warranty meeting the requirements of the Contract.
   n. Copy of any service contracts provided for the specific piece of equipment as part of the Contract.

6. Additional information as required in the associated equipment or system Specification Section.

D. Building Materials and Finishes Operation and Maintenance Manual Content:
   1. Building products, applied materials and finishes:
      a. Include product data, with catalog number, size, composition and color and texture designations.
      b. Provide information for ordering custom manufactured products.
   2. Necessary precautions:
      a. Include product MSDS for each approved product.
      b. Include any precautionary application and storage guidelines.
   3. Instructions for care and maintenance:
      a. Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods and recommended schedule for cleaning and maintenance.
   4. Moisture protection and weather exposed products:
      a. Include product data listing, applicable reference standards, chemical composition, and details of installation.
      b. Provide recommendations for inspections, maintenance and repair.
   5. Additional requirements as specified in individual product specifications.
1.6 TRANSMITTAL OF SUBMITTALS

A. Operation and Maintenance Manuals.
   1. Transmit all submittals to:
      a. The address specified in Specification Section 01340 - SUBMITTALS.
   2. Transmittal form: Use Operation and Maintenance Manual Transmittal, Exhibit A.
   3. Transmittal numbering:
      a. Number each submittal with the Specification Section number followed by a series
         number beginning with ".01" and increasing sequentially with each additional
         transmittal, followed by ".-OM" (for example: 11061-01-OM).
   4. Submit draft and final Operation and Maintenance Manual in electronic format (PDF) to
      Engineer, until manual is approved.

B. Expedited Return Delivery:
   1. Include prepaid express envelope or air bill in submittal transmittal package for any
      submittals Contractor expects or requires express return mail.
   2. Inclusion of prepaid express envelope or air bill does not obligate Engineer to conduct
      expedited review of submittal.

1.7 ENGINEER'S REVIEW ACTION

A. Draft Electronic (PDF) Submittals:
   1. Engineer will review and indicate one of the following review actions:
      a. A - ACCEPTABLE
      b. B - FURNISH AS NOTED
      c. C - REVISE AND RESUBMIT
      d. D - REJECTED
   2. Submittals marked as Acceptable or Furnish As Noted will be retained; however, the
      transmittal form will be returned with a request for the final paper and electronic documents
      to be submitted.
   3. Copies of submittals marked as Revise and Resubmit or Rejected will be returned with the
      transmittal form marked to indicate deficient areas.
   4. Resubmit until approved.

B. Final Paper Copy Submittals:
   1. Engineer will review and indicate one (1) of the following review actions:
      a. A - ACCEPTABLE
      b. D - REJECTED
   2. Submittals marked as Acceptable will be retained with the transmittal form returned as
      noted.
   3. Submittals marked as Rejected will be returned with the transmittal form marked to indicate
      deficient areas.
   4. Resubmit until approved.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION
### EXHIBIT A  Operation and Maintenance Manual

**Transmittal**

(Spec Section)  (Series)  

---

**Project Name:**

**Date Received:**

**Project Owner:**

**Checked By:**

**Contractor:**

**Owner:**

**Log Page:**

**Address:**

**Address:**

**HDR No.:**

**Attn:**

**Attn:**

1st. Sub.  

ReSub.  

---

**Date Transmitted:**

**Previous Transmittal Date:**

<table>
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<tr>
<th>No. Copies</th>
<th>Description of Item</th>
<th>Manufacturer</th>
<th>Dwg. or Data No.</th>
<th>Action Taken*</th>
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**Remarks:**

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**To:**  

**From:**

**HDR Engineering, Inc.**

**Date:**

* The Action designated above is in accordance with the following legend:

- A - Acceptable
- B - Furnish as Noted
- C - Revise and Resubmit
- D - Rejected

**Comments:**

---

**Distribution:**

**Contractor**  

**File**  

**Field**  

**Owner**  

**Other**

---

By  

Date  

Copyright 1991-2013 HDR Engineering, Inc.
## Equipment Data and Spare Parts Summary

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<th>Project Name</th>
<th>Specification Section</th>
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<td>Equipment Manufacturer</td>
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### MECHANICAL NAMEPLATE DATA

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### ELECTRICAL NAMEPLATE DATA

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### SPARE PARTS PROVIDED PER CONTRACT

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### RECOMMENDED SPARE PARTS

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(Jun 1990; Revised Oct 2001, Revised Nov 2007)
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# Recommended Maintenance Summary

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<th>RECOMMENDED BREAK-IN MAINTENANCE (FIRST OIL CHANGES, ETC.)</th>
<th>INITIAL COMPLETION * FOLLOWING START-UP</th>
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<td>D W M Q S A RT Hours</td>
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<table>
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<th>RECOMMENDED PREVENTIVE MAINTENANCE</th>
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<td></td>
<td>D W M Q S A RT Hours</td>
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</table>

* D = Daily  W = Weekly  M = Monthly  Q = Quarterly  S = Semiannual  A = Annual  Hours = Run Time I

(Jun 1990; Revised Oct 2001, Revised Nov 2007)
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## Lubrication Summary

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(Feb 1991; Revised Oct 2001, Revised Nov 2007)
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SECTION 01560
ENVIRONMENTAL PROTECTION AND SPECIAL CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Minimizing the pollution of air, water, or land; control of noise, the disposal of solid waste
      materials, and protection of deposits of historical or archaeological interest.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.

1.2 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Prior to the start of any construction activities submit:
      a. A detailed proposal of all methods of control and preventive measures to be utilized for
         environmental protection.
      b. A drawing of the work area, haul routes, storage areas, access routes and current land
         conditions including trees and vegetation.
      c. A copy of the NPDES permit for storm water discharges from construction activities.
      d. A copy of the approved pollution prevention plan.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Employ and utilize environmental protection methods, obtain all necessary permits, and fully
   observe all local, state, and federal regulations.

B. Land Protection:
   1. Except for any work or storage area and access routes specifically assigned for the use of
      the Contractor, the land areas outside the limits of construction shall be preserved in their
      present condition.
      a. Contractor shall confine his construction activities to areas defined for work within the
         Contract Documents.
   2. Manage and control all borrow areas, work or storage areas, access routes and embankments
      to prevent sediment from entering nearby water or land adjacent to the work site.
   3. Restore all disturbed areas including borrow and haul areas and establish permanent type of
      locally adaptable vegetative cover.
   4. Unless earthwork is immediately paved or surfaced, protect all side slopes and backslopes
      immediately upon completion of final grading.
   5. Plan and execute earthwork in a manner to minimize duration of exposure of unprotected
      soils.
6. Except for areas designated by the Contract Documents to be cleared and grubbed, the Contractor shall not deface, injure or destroy trees and vegetation, nor remove, cut, or disturb them without approval of the Engineer.
   a. Any damage caused by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense.

C. Surface Water Protection:

1. Utilize, as necessary, erosion control methods to protect side and backslopes, minimize and the discharge of sediment to the surface water leaving the construction site as soon as rough grading is complete.
   a. These controls shall be maintained until the site is ready for final grading and landscaping or until they are no longer warranted and concurrence is received from the Engineer.
   b. Physically retard the rate and volume of run-on and runoff by:
      1) Implementing structural practices such as diversion swales, terraces, straw bales, silt fences, berms, storm drain inlet protection, rocked outlet protection, sediment traps and temporary basins.
      2) Implementing vegetative practices such as temporary seeding, permanent seeding, mulching, sod stabilization, vegetative buffers, hydroseeding, anchored erosion control blankets, sodding, vegetated swales or a combination of these methods.
      3) Providing Construction sites with graveled or rocked access entrance and exit drives and parking areas to reduce the tracking of sediment onto public or private roads.

2. Discharges from the construction site shall not contain pollutants at concentrations that produce objectionable films, colors, turbidity, deposits or noxious odors in the receiving stream or waterway.

D. Solid Waste Disposal:

1. Collect solid waste on a daily basis.
2. Provide disposal of degradable solid waste to an approved solid waste disposal site.
3. Provide disposal of nondegradable solid waste to an approved solid waste disposal site or in an alternate manner approved by Engineer and regulatory agencies.
4. No building materials wastes or unused building materials shall be buried, dumped, or disposed of on the site.

E. Fuel and Chemical Handling:

1. Store and dispose of chemical wastes in a manner approved by regulatory agencies.
2. Take special measures to prevent chemicals, fuels, oils, greases, herbicides, and insecticides from entering drainage ways.
3. Do not allow water used in onsite material processing, concrete curing, cleanup, and other waste waters to enter a drainage way(s) or stream.
4. The Contractor shall provide containment around fueling and chemical storage areas to ensure that spills in these areas do not reach waters of the state.

F. Control of Dust:

1. The control of dust shall mean that no construction activity shall take place without applying all such reasonable measures as may be required to prevent particulate matter from becoming airborne so that it remains visible beyond the limits of construction.
   a. Reasonable measures may include paving, frequent road cleaning, planting vegetative groundcover, application of water or application of chemical dust suppressants.
   b. The use of chemical agents such as calcium chloride must be approved by the State of South Dakota DOT.
2. Utilize methods and practices of construction to eliminate dust in full observance of agency regulations.
3. The Engineer will determine the effectiveness of the dust control program and may request the Contractor to provide additional measures, at no additional cost to Owner.
G. Burning:
1. Do not burn material on the site.
2. If the Contractor elects to dispose of waste materials by burning, make arrangements for an
   off-site burning area and conform to all agency regulations.

H. Control of Noise:
1. Control noise by fitting equipment with appropriate mufflers.

I. Completion of Work:
1. Upon completion of work, leave area in a clean, natural looking condition.
2. Ensure all signs of temporary construction and activities incidental to construction of
   required permanent work are removed.

J. Historical Protection:
1. If during the course of construction, evidence of deposits of historical or archaeological
   interests is found, cease work affecting find and notify Engineer.
   a. Do not disturb deposits until written notice from Engineer is given to proceed.
2. The Contractor will be compensated for lost time or changes in construction to avoid the
   find based upon normal change order procedures.

END OF SECTION
SECTION 01600
PRODUCT DELIVERY, STORAGE, AND HANDLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Scheduling of product delivery.
   2. Packaging of products for delivery.
   3. Protection of products against damage from:
      a. Handling.
      b. Exposure to elements or harsh environments.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.

C. Payment:
   1. No payment will be made to Contractor for equipment or materials not properly stored and
      insured or without approved Shop Drawings.
      a. Previous payments for items will be deducted from subsequent progress estimate(s) if
         proper storage procedures are not observed.

1.2 DELIVERY

A. Scheduling: Schedule delivery of products or equipment as required to allow timely installation
   and to avoid prolonged storage.

B. Packaging: Deliver products or equipment in manufacturer's original unbroken cartons or other
   containers designed and constructed to protect the contents from physical or environmental
   damage.

C. Identification: Clearly and fully mark and identify as to manufacturer, item, and installation
   location.

D. Protection and Handling: Provide manufacturer's instructions for storage and handling.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 PROTECTION, STORAGE AND HANDLING

A. Manufacturer's Instruction:
   1. Protect all products or equipment in accordance with manufacturer's written directions.
      a. Store products or equipment in location to avoid physical damage to items while in
         storage.
      b. Handle products or equipment in accordance with manufacturer's recommendations and
         instructions.
   2. Protect equipment from exposure to elements and keep thoroughly dry.
   3. When space heaters are provided in equipment, connect and operate heaters during storage
      until equipment is placed in service.
3.2 FIELD QUALITY CONTROL

A. Inspect Deliveries:
   1. Inspect all products or equipment delivered to the site prior to unloading.
      a. Reject all products or equipment that are damaged, used, or in any other way
         unsatisfactory for use on Project.

B. Monitor Storage Area: Monitor storage area to ensure suitable temperature and moisture
   conditions are maintained as required by manufacturer or as appropriate for particular items.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Job conditions.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.

1.2 PROJECT CONDITIONS

A. Prior to installation of material, equipment and other work, verify with subcontractors, material
   or equipment manufacturers, and installers that the substrate or surface to which those materials
   attach is acceptable for installation of those materials or equipment. (Substrate is defined as
   building surfaces to which materials or equipment is attached to i.e., floors, walls, ceilings, etc.).

B. Correct unacceptable substrate until acceptable for installation of equipment or materials.

C. Maintaining Facility Operations:

PART 2 - PRODUCTS – (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION – (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. The procedure for requesting the approval of substitution of a product that is not equivalent
to a product which is specified by descriptive or performance criteria or defined by
reference to one or more of the following:
   a. Name of manufacturer.
   b. Name of vendor.
   c. Trade name.
   d. Catalog number.
   2. Substitutions are not "or-equals."
   3. This Specification Section does not address substitutions for major equipment.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.

C. Request for Substitution - General:
   1. Base all bids on materials, equipment, and procedures specified.
   2. Certain types of equipment and kinds of material are described in specifications by means of
      references to names of manufacturers and vendors, trade names, or catalog numbers.
      a. When this method of specifying is used, it is not intended to exclude from consideration
         other products bearing other manufacturer's or vendor's names, trade names, or catalog
         numbers, provided said products are "or-equals," as determined by Engineer.
   3. Other types of equipment and kinds of material may be acceptable substitutions under the
      following conditions:
      a. Or-equals are unavailable due to strike, discontinued production of products meeting
         specified requirements, or other factors beyond control of Contractor; or,
      b. Contractor proposes a cost and/or time reduction incentive to the Owner.

1.2 QUALITY ASSURANCE

A. In making request for substitution or in using an approved product, Contractor represents
Contractor:
   1. Has investigated proposed product, and has determined that it is adequate or superior in all
      respects to that specified, and that it will perform function for which it is intended.
   2. Will provide same guarantee for substitute item as for product specified.
   3. Will coordinate installation of accepted substitution into Work, to include building
      modifications if necessary, making such changes as may be required for Work to be
      complete in all respects.
   4. Waives all claims for additional costs related to substitution which subsequently arise.

1.3 DEFINITIONS

A. Product: Manufactured material or equipment.

1.4 PROCEDURE FOR REQUESTING SUBSTITUTION

A. Substitution shall be considered only:
   1. After Award of Contract.
   2. Under the conditions stated herein.

B. Written request through Contractor only.
C. Transmittal Mechanics:
   1. Follow the transmittal mechanics prescribed for Shop Drawings in Specification Section 01340.
      a. Product substitution will be treated in a manner similar to "deviations," as described in Specification Section 01340.
      b. List the letter describing the deviation and justifications on the transmittal form in the space provided under the column with the heading DESCRIPTION.
         1) Include in the transmittal letter, either directly or as a clearly marked attachment, the items listed in Paragraph D below.

D. Transmittal Contents:
   1. Product identification:
      a. Manufacturer's name.
      b. Telephone number and representative contact name.
      c. Specification Section or Drawing reference of originally specified product, including discrete name or tag number assigned to original product in the Contract Documents.
   2. Manufacturer's literature clearly marked to show compliance of proposed product with Contract Documents.
   3. Itemized comparison of original and proposed product addressing product characteristics including but not necessarily limited to:
      a. Size.
      b. Composition or materials of construction.
      c. Weight.
      d. Electrical or mechanical requirements.
   4. Product experience:
      a. Location of past projects utilizing product.
      b. Name and telephone number of persons associated with referenced projects knowledgeable concerning proposed product.
      c. Available field data and reports associated with proposed product.
   5. Data relating to changes in construction schedule.
   6. Data relating to changes in cost.
   7. Samples:
      a. At request of Engineer.
      b. Full size if requested by Engineer.
      c. Held until substantial completion.
      d. Engineer not responsible for loss or damage to samples.

1.5 APPROVAL OR REJECTION

A. Written approval or rejection of substitution given by the Engineer.

B. Engineer reserves the right to require proposed product to comply with color and pattern of specified product if necessary to secure design intent.

C. In the event the substitution is approved, the resulting cost and/or time reduction will be documented by Change Order in accordance with the General Conditions.

D. Substitution will be rejected if:
   1. Submittal is not through the Contractor with his stamp of approval.
   2. Request is not made in accordance with this Specification Section.
   3. In the Engineer's opinion, acceptance will require substantial revision of the original design.
   4. In the Engineer's opinion, substitution will not perform adequately the function consistent with the design intent.

E. Contractor shall reimburse Owner for the cost of Engineer's evaluation whether or not substitution is approved.
PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION
## Substitution Request Form

(One Item per each Form)

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<td>Specification Section No:</td>
<td>Paragraph No. (i.e. 2.1.A.1.c):</td>
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<td>Proposed Substitution:</td>
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Provide Product Data Sheets, Manufacturer's written installation instructions, drawings, diagrams, or any other information as an attached to this Form that will demonstrate the proposed substitution is an Approved Equal.

In the lines provided state differences between proposed substitutions and specified item. Differences include but are not limited to interrelationship with other items; materials, equipment, function, utility, life cycle costs, applied finished, appearances, and quality.

____________________________________________________________________________________________

____________________________________________________________________________________________

____________________________________________________________________________________________

In the lines provided demonstrate how the proposed substitution is compatible with or modifies other systems, parts, equipment or components of the Project and Work under the Contract:

____________________________________________________________________________________________

____________________________________________________________________________________________

____________________________________________________________________________________________

In the lines provided, describe what effect the proposed substitution has on dimensions indicated on the Drawings and previously reviewed Shop Drawings?

____________________________________________________________________________________________

____________________________________________________________________________________________

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In the lines provided, describe what effect the proposed substitution has on the Construction Schedule and Contract Time.

____________________________________________________________________________________________

____________________________________________________________________________________________

____________________________________________________________________________________________

In the lines provided, describe what effect the proposed substitution has on the Contract Price. This includes all direct, indirect, impact and delay costs.

____________________________________________________________________________________________

____________________________________________________________________________________________

____________________________________________________________________________________________

Manufacturer's guarantees of the proposed and specified items are:

☐ Same

☐ Different (explain on attachment)

The undersigned state that the function, utility, life cycle costs, applied finishes, appearance and quality of the proposed substitution are equal or superior to those of the specified item.

For use by Project Representative:

☐ Accepted  ☐ Accepted as Noted  (Contractor's Signature)

☐ Not Accepted  ☐ Received Too Late  (Contractor's Firm)

(Contractor’s Signature)  (Contractor’s Firm)

(Date)  (Firms Address)

(Contractor’s Signature)  (Contractor’s Firm)

(Contractor’s Signature)  (Contractor’s Firm)

(Telephone)  (Firms Address)

Comments:

____________________________________________________________________________________________

____________________________________________________________________________________________

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SECTION 01650
SYSTEM START-UP

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Procedures and actions, required of the Contractor, which are necessary to achieve and demonstrate Substantial Completion.
   2. Requirements for Substantial Completion Submittals.

B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.

1.2 DEFINITIONS

A. Project Classified System (PCS): A defined part of the Project, consisting of an arrangement of items, such as equipment, structures, components, piping, wiring, materials, or incidentals, so related or connected to form an identifiable, unified, functional, operational, safe, and independent system.

B. Pre-Demonstration Period: The period of time, of unspecified duration after initial construction and installation activities during which Contractor, with assistance from manufacturer's representatives, performs in the following sequence:
   1. Finishing type construction work to ensure the Project has reached a state of Substantial Completion.
   2. Equipment start-up.
   3. Personnel training.

C. Demonstration Period: A period of time, of specified duration, following the Pre-Demonstration Period, during which the Contractor initiates flow through the Project Classified System and starts up and operates the Project Classified System, without exceeding specified downtime limitations, to prove the functional integrity of the mechanical and electrical equipment and components and the control interfaces of the respective equipment and components comprising the Project Classified System as evidence of Substantial Completion.

D. Substantial Completion: See the General Conditions.

1.3 SUBMITTALS

A. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.

B. Submit in the chronological order listed below prior to the completion of the Pre-Demonstration Period.
   1. Master operation and maintenance training schedule:
      a. Submit 30 days (minimum) prior to first training session for Owner's personnel.
      b. Schedule to include:
         1) Target date and time for Owner witnessing of each system initial start-up.
         2) Target date and time for Operation and Maintenance training for each system, both field and classroom.
         3) Target date for initiation of Demonstration Period.
      c. Submit for review and approval by Owner.
d. Include holidays observed by Owner.

e. Attend a schedule planning and coordination meeting 90 calendar days prior to first anticipated training session.

1) Provide a status report and schedule-to-complete for requirements prerequisite to manufacturer's training.

2) Identify initial target dates for individual manufacturer's training sessions.

f. Owner reserves the right to insist on a minimum seven (7) days' notice of rescheduled training session not conducted on master schedule target date for any reason.

g. Schedule to be resubmitted until approved.

2. Substantial Completion Submittal:

a. File Contractor's Notice of Substantial Completion and Request for Inspection.

b. Approved Operation and Maintenance manuals received by Engineer minimum 30 days prior to scheduled training.

c. Written request for Owner to witness each system pre-demonstration start-up.

1) Request to be received by Owner minimum one (1) week before scheduled training of Owner's personnel on that system.

d. Equipment installation and pre-demonstration start-up certifications.

e. Letter verifying completion of all pre-demonstration start-up activities including receipt of all specified items from manufacturers or suppliers as final item prior to initiation of Demonstration Period.

1.4 SEQUENCING AND SCHEDULING

A. Phased Construction:

B. Schedule of Events:

1.5 COST OF START-UP

A. Contractor to pay all costs associated with System start-up.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 GENERAL

A. Facility Start-up Divided into Two Periods:

1. Pre-Demonstration Period including:

a. Completion of construction work to bring Project to a state of Substantial Completion.

b. Start-up of Equipment.

c. Training of Personnel.

d. Completion of the filing of all required submittals.

e. Filing of Contractor's Notice of Substantial Completion and Request for Inspection.

2. Demonstration Period including:

a. Demonstration of functional integrity of facility or PCS.

3.2 PRE-DEMONSTRATION PERIOD

A. Completion of Construction Work:

1. Complete the work to bring the PCS to a state of substantial completion.

B. Equipment Start-up:

1. Requirements for individual items of equipment are included in Division 02 through Division 16 Specification Sections.

2. Prepare the equipment so it will operate properly and safely and be ready to demonstrate functional integrity during the Demonstration Period.
3. Perform Equipment Start-up to extent possible without introducing product flow.
4. Introduce product flow to complete Equipment Start-up for the following equipment:
   a. Chemical feed pumps.
   b. Sump Pump.
5. Procedures include but are not necessarily limited to the following:
   a. Test or check and correct deficiencies of:
      1) Power, control, and monitoring circuits for continuity prior to connection to power source.
      2) Voltage of all circuits.
      3) Phase sequence.
      4) Cleanliness of connecting piping systems.
      5) Alignment of connected machinery.
      6) Vacuum and pressure of all closed systems.
      7) Lubrication.
      8) Valve orientation and position status for manual operating mode.
      9) Tankage for integrity using clean water.
      10) Pumping equipment using product flow.
      11) Tagging and identification systems.
      12) All equipment: Proper connections, alignment, calibration and adjustment.
   b. Calibrate all safety equipment.
   c. Manually rotate or move moving parts to assure freedom of movement.
   d. "Bump" start electric motors to verify proper rotation.
   e. Perform other tests, checks, and activities required to make the equipment ready for Demonstration Period.
   f. Documentation:
      1) Prepare a log showing each equipment item subject to this paragraph and listing what is to be accomplished during Equipment Start-up.
      2) Provide a place for the Contractor to record date and person accomplishing required work.
      3) Submit completed document before requesting inspection for Substantial Completion certification.
6. Obtain certifications, without restrictions or qualifications, and deliver to Engineer:
   a. Manufacturer's equipment installation check letters (sometimes referred to as Manufacturer’s Field Services report).
   b. Instrumentation Supplier's Instrumentation Installation Certificate.
C. Personnel Training:
   1. See individual equipment specification sections.
   2. Conduct all personnel training after completion of Equipment Start-up for the equipment for which training is being conducted.
      a. Personnel training on individual equipment or systems will not be considered completed unless:
         1) All pretraining deliverables are received and approved before commencement of training on the individual equipment or system.
         2) No system malfunctions occur during training.
         3) All provisions of field and classroom training specifications are met.
      b. Training not in compliance with the above will be performed again in its entirety by the manufacturer at no additional cost to Owner.
   3. Field and classroom training requirements:
      a. Hold classroom training on-site.
      b. Notify each manufacturer specified for on-site training that the Owner reserves the right to video record any or all training sessions.
      1) Organize each training session in a format compatible with video recording.
      c. Training instructor qualification: Factory trained and familiar with giving both classroom and "hands-on" instructions.
d. Training instructors:
   1) Be at classes on time.
   2) Session beginning and ending times to be coordinated with the Owner and
      indicated on the master schedule.
   3) Normal time lengths for class periods can vary, but brief rest breaks should be
      scheduled and taken.

e. Organize training sessions into maintenance verses operation topics and identify on
   schedule.

f. Plan for minimum class attendance of 10 people at each session and provide sufficient
   classroom materials, samples, and handouts for those in attendance.

g. Instructors to have a typed agenda and well prepared instructional material.
   1) The use of visual aids, e.g., films, pictures, and slides is recommended for use
      during the classroom training programs.
   2) Deliver agendas to the Engineer a minimum of seven (7) days prior to the
      classroom training.
   3) Provide equipment required for presentation of films, slides, and other visual aids.

h. In the on-site training sessions, cover the information required in the Operation and
   Maintenance Manuals submitted according to Specification Section 01342 and the
   following areas as applicable to PCS's.
   1) Operation of equipment.
   2) Lubrication of equipment.
   3) Maintenance and repair of equipment.
   4) Troubleshooting of equipment.
   5) Preventive maintenance procedures.
   6) Adjustments to equipment.
   7) Inventory of spare parts.
   8) Optimizing equipment performance.
   9) Capabilities.
  10) Operational safety.
  11) Emergency situation response.
  12) Takedown procedures (disassembly and assembly).

i. Address above Paragraphs 1), 2), 8), 9), 10), and 11) in the operation sessions. Address
   above Paragraphs 3), 4), 5), 6), 7), and 12) in the maintenance sessions.

j. Maintain a log of classroom training provided including: Instructors, topics, dates,
   time, and attendance.

D. Complete the filing of all required submittals:
   1. Shop Drawings.
   2. Operation and Maintenance Manuals.
   3. Training material.

e. Filing of Contractor's Notice of Substantial Completion and Request for Inspection of Project or
   PCS:
   1. File the notice when the following have been completed:
      a. Construction work (brought to state of Substantial Completion).
      b. Equipment Start-up.
      c. Personnel Training.
      d. Submittal of required documents.
   2. Engineer will review required submittals for completeness within 5 calendar days of
      Contractor's notice. If complete, Engineer will complete inspection of the Work, within
      10 calendar days of Contractor's notice.
   3. Engineer will inform Contractor in writing of the status of the Work reviewed, within
      14 calendar days of Contractor's notice.
      a. Work determined not meeting state of Substantial Completion:
         1) Contractor: Correct deficiencies noted or submit plan of action for correction
            within 5 days of Engineer's determination.
2) Engineer: Reinspect work within 5 days of Contractor's notice of correction of deficiencies.
3) Reinspection costs incurred by Engineer will be billed to Owner who will deduct them from final payment due Contractor.

b. Work determined to be in state of tentative Substantial Completion: Engineer to prepare tentative "Engineer's Certificate of Substantial Completion."

c. Engineer's Certificate of Substantial Completion:
   1) Certificate tentatively issued subject to successful Demonstration of functional integrity.
   2) Issued for Project as a whole or for one or more PCS.
   3) Issued subject to completion or correction of items cited in the certificate (punch list).
   4) Issued with responsibilities of Owner and Contractor cited.
   5) Executed by Engineer.
   6) Accepted by Owner.
   7) Accepted by Contractor.

d. Upon successful completion of Demonstration Period, Engineer will endorse certificate attesting to the successful demonstration, and citing the hour and date of ending the successful Demonstration Period of functional integrity as the effective date of Substantial Completion.

3.3 DEMONSTRATION PERIOD

A. General:
   1. Demonstrate the functional integrity of the mechanical, electrical, and control interfaces of the respective equipment and components comprising the PCS as evidence of Substantial Completion.
   2. Duration of Demonstration Period: 120 consecutive hours.
   3. If, during the Demonstration Period, the aggregate amount of time used for repair, alteration, or unscheduled adjustments to any equipment or systems that renders the affected equipment or system inoperative exceed 10 percent of the Demonstration Period, the demonstration of functional integrity will be deemed to have failed.
      a. In the event of failure, a new Demonstration Period will recommence after correction of the cause of failure.
      b. The new Demonstration Period shall have the same requirements and duration as the Demonstration Period previously conducted.
   4. Conduct the demonstration of functional integrity under full operational conditions.
   5. Owner will provide operational personnel to provide process decisions affecting plant performance.
      a. Owner's assistance will be available only for process decisions.
      b. Contractor will perform all other functions including but not limited to equipment operation and maintenance until successful completion of the Demonstration Period.
   6. Owner reserves the right to simulate operational variables, equipment failures, routine maintenance scenarios, etc., to verify the functional integrity of automatic and manual backup systems and alternate operating modes.
   7. Time of beginning and ending any Demonstration Period shall be agreed upon by Contractor, Owner, and Engineer in advance of initiating Demonstration Period.
   8. Throughout the Demonstration Period, provide knowledgeable personnel to answer Owner's questions, provide final field instruction on select systems and to respond to any system problems or failures which may occur.
      a. Provide final field instruction on the following systems:
         1) Chemical feed pumps.
         2) Sump pump.
      b. For the above systems, provide a total of 5 HRS instruction, divided among the systems as follows:
         1) Chemical feed pumps – 4 HRS.
2) Sump pump – 1HR.

9. Provide all labor, supervision, utilities, chemicals, maintenance, equipment, vehicles or any other item necessary to operate and demonstrate all systems being demonstrated.

END OF SECTION
SECTION 01710
CLEANING

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Intermediate and final cleaning of Work not including special cleaning of closed systems
      specified elsewhere.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.

1.2 STORAGE AND HANDLING
A. Store cleaning products and cleaning wastes in containers specifically designed for those
   materials.

1.3 SCHEDULING
A. Schedule cleaning operations so that dust and other contaminants disturbed by cleaning process
   will not fall on newly painted surfaces.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Cleaning Agents:
   1. Compatible with surface being cleaned.
   2. New and uncontaminated.
   3. For Manufactured Surfaces: Material recommended by manufacturer.

PART 3 - EXECUTION

3.1 CLEANING - GENERAL
A. Prevent accumulation of wastes that create hazardous conditions.
B. Conduct cleaning and disposal operations to comply with laws and safety orders of governing
   authorities.
C. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary
   drains or sewers.
D. Dispose of degradable debris at an approved solid waste disposal site.
E. Dispose of nondegradable debris at an approved solid waste disposal site or in an alternate
   manner approved by Engineer and regulatory agencies.
F. Handle materials in a controlled manner with as few handlings as possible.
G. Do not drop or throw materials from heights greater than 4 FT or less than 4 FT if conditions
   warrant greater care.
H. On completion of work, leave area in a clean, natural looking condition.
1. Remove all signs of temporary construction and activities incidental to construction of required permanent Work.

I. Do not burn on-site.

### 3.2 INTERIOR CLEANING

A. Cleaning During Construction:
   1. Keep work areas clean so as not to hinder health, safety or convenience of personnel in existing facility operations.
   2. At maximum weekly intervals, dispose of waste materials, debris, and rubbish.
   3. Vacuum clean interior areas when ready to receive finish painting.
      a. Continue vacuum cleaning on an as-needed basis, until substantial completion.

B. Final Cleaning:
   1. Complete immediately prior to Demonstration Period.
   2. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed surfaces.
   3. Wipe all lighting fixture reflectors, lenses, lamps and trims clean.
   4. Wash and shine glazing and mirrors.
   5. Polish glossy surfaces to a clear shine.
   6. Ventilating systems:
      a. Clean permanent filters and replace disposable filters if units were operated during construction.
      b. Clean ducts, blowers and coils if units were operated without filters during construction.
   7. Replace all burned out lamps.
   8. Broom clean process area floors.
   9. Mop office and control room floors.

### 3.3 EXTERIOR (SITE) CLEANING

A. Cleaning During Construction:
   1. Construction debris:
      a. Confine in strategically located container(s):
         1) Cover to prevent blowing by wind.
         2) Haul from site minimum once a week.
      b. Remove from work area to container daily.
   2. Vegetation: Keep weeds and other vegetation trimmed to 3 IN maximum height.
   3. Soils, sand, and gravel deposited on paved areas and walks:
      a. Remove as required to prevent muddy or dusty conditions.
      b. Do not flush into storm sewer system.

B. Final Cleaning:
   1. Remove trash and debris containers from site.
      a. Re-seed areas disturbed by location of trash and debris containers.
   2. Clean paved roadways.

### 3.4 FIELD QUALITY CONTROL

A. Immediately prior to Demonstration Period, conduct an inspection with Engineer to verify condition of all work areas.

END OF SECTION
SECTION 01800
OPENINGS AND PENETRATIONS IN CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Methods of installing and sealing openings and penetrations in construction.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 05505 - Metal Fabrications.
   4. Section 07600 - Flashing and Sheet Metal.
   5. Section 07900 - Joint Sealants.
   6. Section 09905 - Painting and Protective Coatings.

1.2 QUALITY ASSURANCE
A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 318, Building Code Requirements for Structural Concrete.
   2. ASTM International (ASTM):
      a. 70, National Electrical Code (NEC):
         1) Article 501, Class I Locations.
      b. 90A, Standard for Installation of Air Conditioning and Ventilating Systems.
   4. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
B. Obtain prior approval from Engineer when any opening larger than 100 SQ IN must be made in existing or newly completed construction.

1.3 DEFINITIONS
A. Hazardous Areas: Areas shown in the Contract Documents as having Class I or Class II area classifications.
B. Washdown Areas: Areas having floor drains or hose bibs.

1.4 SUBMITTALS
A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. For each structure provide dimensioned or scaled (minimum 1/8 IN = 1 FT) plan view drawings containing the following information:
      a. Vertical and horizontal location of all required openings and penetrations.
      b. Size of all openings and penetrations.
      c. Opening type.
      d. Seal type.
   3. Manufacturer's installation instructions for standard manufactured products.
1.5 PROJECT CONDITIONS

A. Refer to the soils report for water table depth. The water table elevation listed in the soils report may change. It is the Contractor’s responsibility to verify the water table elevation and to provide shoring and dewatering as necessary to complete the project.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe Sleeves: Steel, ASTM A53, Schedule 40, galvanized.
B. Pipe Sleeves Penetrating into Corrosive Areas: Stainless steel, 1/4 IN minimum thickness.
C. Backing Rod and Sealant: See Specification Section 07900.
D. Modular Mechanical Seals:
   1. Acceptable manufacturers:
      a. Link-Seal.
   2. 316 stainless steel bolts, nuts and washers.
E. Sheet Metal Sleeves: Steel, ASTM A36, 12 GA.
F. Commercial Wall Castings:
   1. For unclassified areas both sides of penetration:
      a. Ductile iron, class equal to connecting piping system.
   2. For wet/corrosive areas either side of penetration:
      a. Stainless steel, 304L.

PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

A. Perform HVAC penetrations in accordance with NFPA 90A.
B. Perform electrical penetrations in accordance with NFPA 70, Article 501.
C. Install sleeves and castings in accordance with ACI 318, Chapter #6.
D. When mechanical or electrical work cannot be installed as structure is being erected, provide and arrange for building-in of boxes, sleeves, insets, fixtures or devices necessary to permit installation later.
   1. Lay out chases, holes or other openings which must be provided in masonry, concrete or other work.
E. Where pipes, conduits or ducts pass through floors in washdown areas, install sleeves with top 3 IN above finish floors.
   1. In non-washdown areas, install sleeves with ends flush with finished surfaces.
F. Size sleeves, blockouts and cutouts which will receive sealant seal such that free area to receive sealant is minimized and seal integrity may be obtained.
G. For insulated piping and ducts, size sleeves, blockouts and cutouts large enough to accommodate full thickness of insulation.
H. Do not cut into or core drill any beams, joists, or columns.
I. Do not install sleeves in beams, joists, or columns.
J. Do not install recesses in beams, joists, columns, or slabs.
K. Field Cutting and Coring:
   1. Saw or core drill with non-impact type equipment.
   2. Mark opening and drill small 3/4 IN or less holes through structure following opening outline.
   3. Sawcut opening outline on both surfaces.
      a. Knock out within sawcuts using impact type equipment.
      b. Do not chip or spall face of surface to remain intact.
      c. Do not allow any overcut with saw kerf.

L. Precast-Prestressed Concrete Construction:
   1. Do not cut openings nor core drill vertically or horizontally through stems of members.
   2. Do not locate or install sleeves or recess sleeves vertically or horizontally through or in stems of members.
   3. Cast openings and sleeves into flanges of units.
   4. Cast openings larger than 6 IN in diameter or 6 IN maximum dimension in units at time of manufacture.
   5. Cast openings smaller than 6 IN in diameter or 6 IN maximum dimensions in flanges of units at time of manufacture or field cut.

M. Where alterations are necessary or where new and old work join, restore adjacent surfaces to their condition existing prior to start of work.

N. Provide waterstop plate/anchor flange for piping, ducts, castings and sleeves cast-in-place in concrete.
   1. For fabricated units, weld plate to sleeve, pipe, or ductwork.
   2. For commercial castings, cast water stop/anchor with wall pipe.
   3. Plate is to be same thickness as sleeve, pipe, casting or ductwork.
   4. For fabricated units, diameter of plate or flange to be 4 IN larger than outside diameter of sleeve, pipe or ductwork.
   5. For commercial castings, waterstop/anchor size to be manufacturer standard.
   6. Provide continuous around entire circumference of sleeve, pipe, or ductwork.

O. Where area is blocked out to receive sheet metal sleeve at later date:
   1. If blockout size is sufficient to allow placement, utilize dowels for interface of initially placed concrete and sleeve encasement concrete which is placed later.
      a. Size blockout based on sleeve size required plus 4 to 6 IN each side of sleeve for concrete encasement.
      b. Provide #4 dowels at 12 IN spacing along each side of blockout with minimum of two (2) dowels required per side.
   2. If blockout size is not sufficient to allow placement of dowels, provide keyway along all sides of blockout.
      a. Size blockout based on sleeve size required plus 2 to 4 IN each side of sleeve for concrete encasement.

P. For interior wall applications where backer rod and sealant are specified, provide backer rod and sealant at each side of wall.

Q. Refer to Drawings for location of fire-rated walls, floors, and ceilings.

R. Use full depth expanding foam sealant for seal applications where single or multiple pipes, conduits, etc., pass through a single sleeve.

S. Do not make duct or conduit penetrations below high water levels when entering or leaving tankage, wet wells, or other water holding structures.

T. Modular Mechanical Seals:
   1. Utilize one (1) seal for concrete thickness less than 8 IN and two (2) seals for concrete, 8 IN thick or greater.
   2. Utilize two (2) seals for piping 16 IN diameter and larger if concrete thickness permits.
   3. Install seals such that bolt heads are located on the most accessible side of the penetration.
U. Backer Rod and Sealant:
   1. Install in accordance with Specification Section 07900.
   2. Provide backer rod and sealant for modular mechanical seal applications.
      a. Apply on top side of slab penetrations and on interior, dry side wall penetrations.

3.2 SCHEDULES

A. Provide openings and penetrations as shown on the Drawings. If an opening or penetration is not defined on the Drawings, provide penetration as described below.

B. General Schedule of Penetrations through Floors, Roofs, Foundation Base Slabs, Foundation Walls, Foundation Footings, Partitions and Walls for Ductwork, Piping, and Conduit:
   1. Provide the following opening and penetration types:
      a. Type A - Block out 2 IN larger than outside dimensions of duct, pipe, or conduits.
      b. Type B - Saw cut or line-drill opening. Place new concrete with integrally cast sheet metal or pipe sleeve.
      c. Type C - Fabricated sheet metal sleeve or pipe sleeve cast-in-place. Provide pipe sleeve with water ring for wet and/or washdown areas.
      d. Type D - Commercial type casting or fabrication.
      e. Type E - Saw cut or line-drill opening. Place new concrete with integrally cast pipe, duct or conduit spools.
      f. Type F - Integrally cast pipe, duct or conduit.
      g. Type G - Saw cut or line-drill and remove area 1 IN larger than outside dimensions of duct, pipe or conduit.
      h. Type H - Core drill.
      i. Type I - Block out area. At later date, place new concrete with integrally cast sheet metal or pipe sleeve.
   2. Provide seals of material and method described as follows.
      a. Category 1 - Modular Mechanical Seal.
      b. Category 2 - Roof curb and flashing according to SMACNA specifications unless otherwise noted on Drawings. Refer to Specification Section 07600 and roofing Specification Sections for additional requirements.
      c. Category 3 - 12 GA sheet metal drip sleeve set in bed of silicon sealant with backing rod and sealant used in sleeve annulus.
      d. Category 4 - Backer rod and sealant.
      e. Category 5 - Full depth compressible sealant with escutcheons on both sides of opening.
      f. Category 6 - Full depth compressible sealant and flanges on both sides of opening. Flanges constructed of same material as duct, fastened to duct and minimum 1/2 IN larger than opening.
      g. Category 7 - Full depth compressible sealant and finish sealant or full depth expanding foam sealant depending on application.
   3. Furnish openings and sealing materials through new floors, roofs, partitions and walls in accordance with Schedule A, Openings and Penetrations for New Construction.
   4. Furnish openings and sealing materials through existing floors, roofs, partitions and walls in accordance with Schedule B, Openings and Penetrations for Existing Construction.
## SCHEDULE A. OPENINGS AND PENETRATIONS SCHEDULE
### FOR NEW CONSTRUCTION

<table>
<thead>
<tr>
<th>APPLICATIONS</th>
<th>DUCTS</th>
<th>PIPING</th>
<th>CONDUIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OPENING TYPE</td>
<td>SEAL CATEGORY</td>
<td>OPENING TYPE</td>
</tr>
<tr>
<td>Through floors with bottom side a hazardous location</td>
<td>C</td>
<td>F</td>
<td>7</td>
</tr>
<tr>
<td>Through floors on grade above water table</td>
<td>C</td>
<td>F</td>
<td>4</td>
</tr>
<tr>
<td>Through slab on grade below water table</td>
<td>F</td>
<td>Not Req</td>
<td>F</td>
</tr>
<tr>
<td>Through floors in washdown areas</td>
<td>C</td>
<td>I</td>
<td>4</td>
</tr>
<tr>
<td>Through walls where one side is a hazardous area</td>
<td>C</td>
<td>F</td>
<td>7</td>
</tr>
<tr>
<td>Through exterior wall below grade above water table</td>
<td>C</td>
<td>F</td>
<td>7</td>
</tr>
<tr>
<td>Through wall from tankage or wet well (above high water level) to dry well or dry area</td>
<td>C</td>
<td>F</td>
<td>7</td>
</tr>
<tr>
<td>Through wall from tankage or wet well (below high water level) to dry well or dry area</td>
<td>F</td>
<td>Not Req</td>
<td>F</td>
</tr>
<tr>
<td>Through exterior wall above grade</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Roof penetrations</td>
<td>A</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>Through interior walls and slabs not covered by the above applications</td>
<td>A</td>
<td>C</td>
<td>4</td>
</tr>
</tbody>
</table>
## SCHEDULE B. OPENINGS AND PENETRATIONS SCHEDULE

**FOR EXISTING CONSTRUCTION**

<table>
<thead>
<tr>
<th>APPLICATIONS</th>
<th>DUCTS</th>
<th>PIPING</th>
<th>CONDUIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OPENING TYPE</td>
<td>SEAL CATEGORY</td>
<td>OPENING TYPE</td>
</tr>
<tr>
<td>Through floors with bottom side a hazardous location</td>
<td>B</td>
<td>7</td>
<td>Not Req</td>
</tr>
<tr>
<td>Through floors on grade above water table</td>
<td>B</td>
<td>7</td>
<td>B</td>
</tr>
<tr>
<td>Through slab on grade below water table</td>
<td>E</td>
<td>Not Req</td>
<td>E</td>
</tr>
<tr>
<td>Through floors in washdown areas</td>
<td>G</td>
<td>3</td>
<td>G (2)</td>
</tr>
<tr>
<td>Through walls where one side is a hazardous area</td>
<td>B</td>
<td>7</td>
<td>Not Req</td>
</tr>
<tr>
<td>Through exterior wall below grade above water table</td>
<td>B</td>
<td>7</td>
<td>B (1)</td>
</tr>
<tr>
<td>Through wall from tankage or wet well (above high water level) to dry well or dry area</td>
<td>B</td>
<td>7</td>
<td>B (1)</td>
</tr>
<tr>
<td>Through wall from tankage or wet well (below high water level) to dry well or dry area</td>
<td>E</td>
<td>Not Req</td>
<td>E</td>
</tr>
<tr>
<td>Through exterior wall above grade</td>
<td>G</td>
<td>6</td>
<td>G (1)(2)</td>
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<tr>
<td>Roof penetrations</td>
<td>G</td>
<td>2</td>
<td>G (1)(2)</td>
</tr>
<tr>
<td>Through interior walls and slabs not covered by the above applications</td>
<td>G</td>
<td>4</td>
<td>G (1)(2)</td>
</tr>
</tbody>
</table>

(1) Multiple piping 3 IN and smaller or multiple conduits.
(2) Single pipe 3 IN and smaller or single conduit.
(3) Single pipe or conduit larger than 3 IN.

END OF SECTION
DIVISION 02
SITE WORK
SECTION 02072
DEMOLITION, CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Demolition, cutting and patching of existing construction where shown on Drawings, or as
      required to accommodate new work shown or specified.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 03348 - Concrete Finishing and Repair of Surface Defects.
   4. Section 09905 - Painting and Protective Coatings.

1.2 SUBMITTALS
A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Indicating manufacturer and type of:
      a. Proposed nonshrink grout.
      b. Epoxy bonding adhesive.
      c. Proposed materials and methods to be used for matching and repairing existing
         construction.

1.3 DELIVERY, STORAGE, AND HANDLING
A. General:
   1. Clean, list and tag for storage.
   2. Protect from damage and deliver to location designated.
   3. Salvage each item with auxiliary or associated equipment required for operation.

1.4 PROJECT CONDITIONS
A. Perform preliminary investigations as required to ascertain extent of work.

1.5 SEQUENCING AND SCHEDULING
A. Coordinate and reschedule work as required to preclude interference with other operations.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Subject to compliance with the Contract Documents, the following products and manufacturers
   are acceptable:
   1. Nonshrink grout:
      a. Supreme Grout by Gifford Hill.
      b. Masterflow 713 Plus by BASF Building Systems.
      c. Sika Grout 212 by Sika.
      d. Five Star Grout by Five Star Products, Inc.
2. Epoxy bonding adhesive:
   a. Euco No.452 MV by Euclid Chemical Co.
   b. Sikadur 32, Hi-Mod by Sika Corporation.
3. Epoxy patch:
   a. Depth of patch:
      2) Between 1/8 IN and 3/4 IN: Five Star Fluid Epoxy.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. Temporary Partitions:
   1. Plywood: 1/2 IN minimum for interior or exterior use.
   2. Paneling: 1/4 IN minimum for interior use.
B. Nonshrink Grout:
   1. Nonmetallic, noncorrosive and nonstaining.
   2. Premixed with only water to be added in accordance with manufacturer's instructions at jobsite.
   3. Grout to produce a positive but controlled expansion.
      a. Mass expansion not to be created by gas liberation or by other means.
   4. Minimum compressive strength at 28 days to be 6500 psi.
   5. Coat exposed edges of grout with a cure/seal compound recommended by grout manufacturer.
C. Epoxy Bonding Adhesive:
   1. Two component, moisture insensitive adhesive manufactured for the purpose of bonding fresh concrete to hardened concrete.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide temporary partitions as required in public areas.
   1. Construct partitions of braced plywood in exterior areas.
   2. Adequately braced paneling may be used in interior areas.
B. Provide covered passageways where necessary to ensure safe passage of persons in or near areas of work.
C. Provide substantial barricades and safety lights as required.
D. Provide temporary dustproof partitions where indicated or necessary.
   1. Prevent infiltration of dust into occupied areas.
E. Provide temporary weather protection as necessary.

3.2 INSTALLATION

A. Cutting and Removal:
   1. Remove existing work indicated to be removed, or as necessary for installation of new work.
   2. Neatly cut and remove materials, and prepare all openings to receive new work.
   3. Remove masonry or concrete in small sections.
B. Modification of Existing Concrete:
   1. Where indicated, remove existing concrete and finish remaining surfaces as specified in Specification Section 03348.
      a. Protect remaining concrete from damage.
b. Make openings by sawing through the existing concrete.
c. Break out concrete after initial saw cuts in the event concrete thickness prevents cutting through.
d. Make openings by drilling holes around perimeter of opening and then chipping out the concrete where sawing is not possible.
   1) Holes shall be sufficient in number to prevent damage to remaining concrete.

2. Oversize required openings in existing concrete 1 IN on all sides and build back to required opening size by means of nonshrink grout epoxy bonded to the existing concrete.

3. Where oversized openings cannot be made, remove the concrete to the required opening size and cut back exposed reinforcing 1 IN from face of concrete and fill resulting holes with nonshrink grout.

C. Removal of Existing Anchor Bolts or Other Protruding Elements:
   1. Remove all protruding elements.
   2. Remove to a depth of 1/4 IN from finished surface.
   3. Fill void with epoxy patch.

D. Matching and Patching:
   1. Walls, ceilings, floors or partitions:
      a. Repair abutting walls, ceilings, floors or partitions disturbed by removal.
      b. Match and patch existing construction disturbed during installation of new work.
   2. Methods and materials:
      a. Similar in appearance, and equal in quality to adjacent areas for areas or surfaces being repaired.
      b. Subject to review of Owner.
   3. Reinforcing steel that is cut and exposed:
      a. Remove to a depth of 1/4 IN.
      b. Fill void with epoxy patch.

E. Clean Up: Transport debris and legally dispose of off-site.

END OF SECTION
SECTION 02110
SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Site clearing, tree protection, stripping topsoil and demolition.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 02200 - Earthwork.
   4. Section 02260 - Topsoiling and Finished Grading.
   5. Section 02270 - Soil Erosion and Sediment Control.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect existing trees and other vegetation to remain against damage.
   1. Do not smother trees by stockpiling construction materials or excavated materials within drip line.
   2. Avoid foot or vehicular traffic or parking of vehicles within drip line.
   3. Provide temporary protection as required.

B. Repair or replace trees and vegetation damaged by construction operations.
   1. Repair to be performed by a qualified tree surgeon.
   2. Remove trees which cannot be repaired and restored to full-growth status.
   3. Replace with new trees of minimum 4 IN caliper.

C. Owner will obtain authority for removal and alteration work on adjoining property.

3.2 SITE CLEARING

A. Topsoil Removal:
   1. Strip topsoil to depths encountered.
      a. Remove heavy growths of grass before stripping.
      b. Stop topsoil stripping sufficient distance from such trees to prevent damage to main root system.
      c. Separate from underlying subsoil or objectionable material.
   2. Stockpile topsoil where directed by Engineer.
      a. Construct storage piles to freely drain surface water.
      b. Seed or cover storage piles to prevent erosion.
   3. Do not strip topsoil in wooded areas where no change in grade occurs.
   4. Borrow topsoil: Reasonably free of subsoil, objects over 2 IN DIA, weeds and roots.

B. Clearing and Grubbing:
   1. Clear from within limits of construction all trees not marked to remain.
      a. Include shrubs, brush, downed timber, rotten wood, heavy growth of grass and weeds, vines, rubbish, structures and debris.
2. Grub (remove) from within limits of construction all stumps, roots, root mats, logs and debris encountered.
   a. Totally grub under areas to be paved.
   b. Grubbing in lawn areas:
      1) In cut areas, totally grub.
      2) In fill areas, where fill is less than 3 FT totally grub ground.
      3) Where fill is 3 FT or more in depth, stumps may be left no higher than 6 IN above existing ground surface.

C. Disposal of Waste Materials:
   1. Do not burn combustible materials on site.
   2. Remove all waste materials from site.
   3. Do not bury organic matter on site.

3.3 ACCEPTANCE

A. Upon completion of the site clearing, obtain Engineer's acceptance of the extent of clearing, depth of stripping and rough grade.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Earthwork.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 07190 - Under Slab Vapor Retarder.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using
         Standard Effort (12,400 ft-lbf/ft³).
      c. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil
         Using Modified Effort (56,000 ft-lbf/ft³(2,700 kN-m/m)).
      d. D3786, Standard Test Method for Bursting Strength of Textile Fabrics--Diaphragm
         Bursting Strength Tester Method.
      e. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils
         Using a Vibratory Table.
      f. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils
         and Calculation of Relative Density.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Certifications.
   4. Test reports:
      a. Soils inspection and testing results.

B. Samples:
   1. Submit samples and source of fill and backfill materials proposed for use.
   2. Submit samples and source of borrow materials proposed for use.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill:
   1. Clay backfill material:
      a. Onsite existing fill material is not acceptable.
      b. Selected material approved by Soils Engineer from site excavation or from off site borrow.
      c. Provide non-organic clay having a liquid limit less than 45.
         1) Selected material approved by Soils Engineer from site excavation or from off site borrow.
   2. Sand backfill material:
      a. Free draining sand containing no more than 5 percent by weight passing sieve #200.
      b. Provide 2 FT of clayey soil cap.

B. Structural Fill/Granular Fill Under Building Floor Slabs-On-Grade:
   1. Clean, crushed, nonporous rock, crushed or uncompressed gravel complying with ASTM C33 gradation size No. 67, 3/4 IN to No. 4.
      a. Less than 15 percent by weight passing #200 sieve.

C. Geotextile Filter Fabric:
   1. Nonwoven type.
   2. Equivalent opening size: 50-100 (U.S. Standard Sieve).
   3. Permeability coefficient (cm/second): 0.07 minimum, 0.30 maximum.
   4. Grab strength: 90 LBS minimum in either direction in accordance with ASTM D4632 requirements.
   5. Mullen burst strength: 125 psi minimum in accordance with ASTM D3786 requirements.

D. Vapor Barrier: Refer to Specification Section 07190.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect existing surface and subsurface features on-site and adjacent to site as follows:
   1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
   2. Protect and maintain bench marks, monuments or other established reference points and property corners.
      a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
   3. Verify location of utilities.
      a. Omission or inclusion of utility items does not constitute nonexistence or definite location.
      b. Secure and examine local utility records for location data.
      c. Take necessary precautions to protect existing utilities from damage due to any construction activity.
      d. Repair damages to utility items at own expense.
      e. In case of damage, notify Engineer at once so required protective measures may be taken.
   4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
      a. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
      b. All repairs to be made and paid for by Contractor.
5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.

6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.

7. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.

B. Salvageable Items: Carefully remove items to be salvaged, and store on Owner's premises unless otherwise directed.

C. Dispose of waste materials, legally, off site.

1. Burning, as a means of waste disposal, is not permitted.

3.2 SITE EXCAVATION AND GRADING

A. The work includes all operations in connection with excavation, borrow, construction of fills and embankments, rough grading, and disposal of excess materials in connection with the preparation of the site(s) for construction of the proposed facilities.

B. Excavation and Grading:

1. Perform as required by the Contract Drawings.

2. Contract Drawings may indicate both existing grade and finished grade required for construction of Project.

   a. Stake all units, structures, piping, roads, parking areas and walks and establish their elevations.

   b. Perform other layout work required.

   c. Replace property corner markers to original location if disturbed or destroyed.

3. Preparation of ground surface for embankments or fills:

   a. Before fill is started, scarify to a minimum depth of 6 IN in all proposed embankment and fill areas.

   b. Where ground surface is steeper than one vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill material will bind with existing surface.

4. Protection of finish grade:

   a. During construction, shape and drain embankment and excavations.

   b. Maintain ditches and drains to provide drainage at all times.

   c. Protect graded areas against action of elements prior to acceptance of work.

   d. Reestablish grade where settlement or erosion occurs.

C. Borrow:

1. Provide necessary amount of approved fill compacted to density equal to that indicated in this Specification.

2. Include cost of all borrow material in original proposal.

3. Fill material to be approved by Soils Engineer prior to placement.

D. Construct embankments and fills as required by the Contract Drawings:

1. Construct embankments and fills at locations and to lines of grade indicated.

   a. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.

2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 IN.

   a. Ensure that stones larger than 4 IN are not placed in upper 6 IN of fill or embankment.

   b. Do not place material in layers greater than 8 IN loose thickness.

   c. Place layers horizontally and compact each layer prior to placing additional fill.

3. Compact by sheepsfoot, pneumatic rollers, vibrators, or by other equipment as required to obtain specified density.

   a. Control moisture for each layer necessary to meet requirements of compaction.
### 3.3 USE OF EXPLOSIVES

A. Blasting with any type of explosive is prohibited.

### 3.4 FIELD QUALITY CONTROL

A. Do not include in bid price the cost of inspection services indicated herein as being performed by the Soils Engineer.

B. Moisture density relations:
   1. Clay backfill materials:
      a. Moisture content to be maintained within a range of minus 1 percent to minus 4 percent of the materials’ optimum moisture content.
   2. Granular backfill materials:
      a. Maintain moisture content at a level that will be conductive for vibratory compaction.

C. Extent of compaction testing will be as necessary to assure compliance with specifications.

D. Give minimum of 24 HR advance notice to Soils Engineer when ready for compaction or subgrade testing and inspection.

E. Should any compaction density test or subgrade inspection fail to meet specification requirements, perform corrective work as necessary.

F. Pay for all costs associated with corrective work and retesting resulting from failing compaction density tests.

### 3.5 COMPACTION DENSITY REQUIREMENTS

A. Obtain approval from Soils Engineer with regard to suitability of soils and acceptable subgrade prior to subsequent operations.

B. Provide dewatering system necessary to successfully complete compaction and construction requirements.

C. Remove frozen, loose, wet, or soft material and replace with approved material as directed by Soils Engineer.

D. Stabilize subgrade with well graded granular materials as directed by Soils Engineer.

E. Assure by results of testing that compaction densities comply with the following requirements:
   1. Sitework:

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>COMPACTION DENSITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under Paved Areas, Sidewalks and Piping:</td>
<td></td>
</tr>
<tr>
<td>Cohesive soils</td>
<td>95 percent per ASTM D698</td>
</tr>
<tr>
<td>Cohesionless soils</td>
<td>97 percent relative density per ASTM D4253 and ASTM D4254</td>
</tr>
<tr>
<td>Unpaved Areas:</td>
<td></td>
</tr>
<tr>
<td>Cohesive soils</td>
<td>90 percent of ASTM D698</td>
</tr>
<tr>
<td>Cohesionless soils</td>
<td>90 percent relative density per ASTM D4253 and ASTM D4254</td>
</tr>
</tbody>
</table>
2. Structures:

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>COMPACTION DENSITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under foundations, under equipment support pads, under slabs-on-grade and scarified existing subgrade under fill material</td>
<td>97 percent per ASTM D1557</td>
</tr>
<tr>
<td>Outside structures next to walls, piers, columns and any other structure exterior member</td>
<td>95-98 percent per ASTM D1557</td>
</tr>
</tbody>
</table>

3.6 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

A. General:
1. In general, work includes, but is not necessarily limited to, excavation for structures and retaining walls, removal of underground obstructions and undesirable material, backfilling, filling, and fill, backfill, and subgrade compaction.
2. Obtain fill and backfill material necessary to produce grades required.
   a. Materials and source to be approved by Soils Engineer.
   b. Excavated material approved by Soils Engineer may also be used for fill and backfill.
3. In this Specification Section, the word "foundations" includes footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil.
4. In the paragraphs of this Specification Section, the word "soil" also includes any type of rock subgrade that may be present at or below existing subgrade levels.

B. Excavation Requirements for Structures:
1. General:
   a. Do not commence excavation for foundations for structures until Soils Engineer approves:
      1) The removal of topsoil and other unsuitable and undesirable material from existing subgrade.
      2) Density and moisture content of site area compacted fill material meets requirements of specifications.
      3) Site surcharge or mass fill material can be removed from entire construction site or portion thereof.
      4) Surcharge or mass fill material has been removed from construction area or portions thereof.
   b. Engineer grants approval to begin excavations.
2. Dimensions:
   a. Excavate to elevations and dimensions indicated or specified.
   b. Allow additional space as required for construction operations and inspection of foundations.
3. Removal of obstructions and undesirable materials in excavation includes, but is not necessarily limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, and any other materials which may be concealed beneath present grade, as required to execute work indicated on Contract Drawings.
   a. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by Soils Engineer.
4. Level off bottoms of excavations to receive foundations, floor slabs, equipment support pads, or compacted fill.
   a. Remove loose materials and bring excavations into approved condition to receive concrete or fill material.
b. Where compacted fill material must be placed to bring subgrade elevation up to
underside of construction, scarify existing subgrade upon which fill material is to be
placed to a depth of 6 IN and then compact to density stated in this Specification
Section before fill material can be placed thereon.

c. Do not carry excavations lower than shown for foundations except as directed by Soils
Engineer or Engineer.

d. If any part of excavations is carried below required depth without authorization,
maintain excavation and start foundation from excavated level with concrete of same
strength as required for superimposed foundation, and no extra compensation will be
made to Contractor therefore.

5. Make excavations large enough for working space, forms, dampproofing, waterproofing,
and inspection.

6. Notify Soils Engineer and Engineer as soon as excavation is completed in order that
subgrades may be inspected.

a. Do not commence further construction until subgrade under compacted fill material,
under foundations, under floor slabs-on-grade, under equipment support pads, and
under retaining wall footings has been inspected and approved by the Soils Engineer as
being free of undesirable material, being of compaction density required by this
specification, and being capable of supporting the allowable foundation design bearing
pressures and superimposed foundation, fill, and building loads to be placed thereon.

b. Soils Engineer shall be given the opportunity to inspect subgrade below fill material
both prior to and after subgrade compaction.

c. Place fill material, foundations, retaining wall footings, floor slabs-on-grade, and
equipment support pads as soon as weather conditions permit after excavation is
completed, inspected, and approved and after forms and reinforcing are inspected and
approved.

d. Before concrete or fill material is placed, protect approved subgrade from becoming
loose, wet, frozen, or soft due to weather, construction operations, or other reasons.

7. Dewatering:

a. Where groundwater is or is expected to be encountered during excavation, install a
dewatering system to prevent softening and disturbance of subgrade below foundations
and fill material, to allow foundations and fill material to be placed in the dry, and to
maintain a stable excavation side slope.

b. Groundwater shall be maintained at least 3 FT below the bottom of any excavation.

c. Review soils investigation before beginning excavation and determine where
groundwater is likely to be encountered during excavation.

d. Employ dewatering specialist for selecting and operating dewatering system.

e. Keep dewatering system in operation until dead load of structure exceeds possible
buoyant uplift force on structure.

f. Dispose of groundwater to an area which will not interfere with construction operations
or damage existing construction.

1) Install groundwater monitoring wells as necessary.

2) Shut off dewatering system at such a rate to prevent a quick upsurge of water that might
weaken the subgrade.

8. Subgrade stabilization:

a. If subgrade under foundations, fill material, floor slabs-on-grade, or equipment support
pads is in a frozen, loose, wet, or soft condition before construction is placed thereon,
remove frozen, loose, wet, or soft material and replace with approved compacted
material as directed by Soils Engineer.

b. Provide compaction density of replacement material as stated in this Specification
Section.

c. Loose, wet, or soft materials, when approved by Soils Engineer, may be stabilized by a
compacted working mat of well graded crushed stone.

d. Compact stone mat thoroughly into subgrade to avoid future migration of fines into the
stone voids.

e. Remove and replace frozen materials as directed by Soils Engineer.
Method of stabilization shall be performed as directed by Soils Engineer.

Do not place further construction on the repaired subgrades, until the subgrades have been approved by the Soils Engineer.

9. Do not place floor slabs-on-grade including equipment support pads until subgrade below has been approved, piping has been tested and approved, reinforcement placement has been approved, and Contractor receives approval to commence slab construction.
   a. Do not place building floor slabs-on-grade including equipment support pads when temperature of air surrounding the slab and pads is or is expected to be below 40 DegF before structure is completed and heated to a temperature of at least 50 DegF.

10. Protection of structures:
    a. Prevent new and existing structures from becoming damaged due to construction operations or other reasons.
    b. Prevent subgrade under new and existing foundations from becoming wet and undermined during construction due to presence of surface or subsurface water or due to construction operations.

11. Shoring:
    a. Shore, sheet pile, slope, or brace excavations as required to prevent them from collapsing.
    b. Remove shoring as backfilling progresses but only when banks are stable and safe from caving or collapse.

12. Drainage:
    a. Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures.
    b. Maintain excavations where foundations, floor slabs, equipment support pads or fill material are to be placed free of water.
    c. Provide pumping required to keep excavated spaces clear of water during construction.
    d. Should any water be encountered in the excavation, notify Engineer and Soils Engineer.
    e. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.

13. Frost protection:
    a. Do not place foundations, slabs-on-grade, equipment support pads, or fill material on frozen ground.
    b. When freezing temperatures may be expected, do not excavate to full depth indicated, unless foundations, floor slabs, equipment support pads, or fill material can be placed immediately after excavation has been completed and approved.
    c. Protect excavation from frost if placing of concrete or fill is delayed.
    d. Where a concrete slab is a base slab-on-grade located under and within a structure that will not be heated, protect subgrade under the slab from becoming frozen until final acceptance of the Project by the Owner.
    e. Protect subgrade under foundations of a structure from becoming frozen until structure is completed and heated to a temperature of at least 50 DegF.

C. Fill and Backfill Inside of Structure and Below Foundations, Base Slabs, Floor Slabs, Equipment Support Pads and Piping:

1. General:
   a. Subgrade to receive fill or backfill shall be free of undesirable material as determined by Soils Engineer and scarified to a depth of 6 IN and compacted to density specified herein.
   b. Surface may be stepped by at not more than 12 IN per step or may be sloped at not more than 2 percent.
   c. Do not place any fill or backfill material until subgrade under fill or backfill has been inspected and approved by Soils Engineer as being free of undesirable material and compacted to specified density.

2. Obtain approval of fill and backfill material and source from Soils Engineer prior to placing the material.
3. Granular fill under floor slabs-on-grade: Place all floor slabs-on-grade on a minimum of 6 IN of granular fill unless otherwise indicated.

4. Vapor barrier: Install a continuous vapor barrier under floor slabs-on-grade as required by Specification Section 07190 and shown on Contract Drawings.

5. Fill and backfill placement:
   a. Prior to placing fill and backfill material, optimum moisture and maximum density properties for proposed material shall be obtained from Soils Engineer.
   b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
   c. Compact material by means of equipment of sufficient size and proper type to obtain specified density.
   d. Use hand operated equipment for filling and backfilling next to walls.
   e. Do not place fill and backfill when the temperature is less than 40 DegF and when subgrade to receive fill and backfill material is frozen, wet, loose, or soft.
   f. Use vibratory equipment to compact granular material; do not use water.

6. Where fill material is required below foundations, place fill material, conforming to the required density and moisture content, outside the exterior limits of foundations located around perimeter of structure the following horizontal distance whichever is greater:
   a. As required to provide fill material to indicated finished grade.
   b. 5 FT.
   c. Distance equal to depth of compacted fill below bottom of foundations.
   d. As directed by Soils Engineer.

D. Filling and Backfilling Outside of Structures.
   1. This paragraph of this Specification applies to fill and backfill placed outside of structures above bottom level of both foundations and piping but not under paving.
   2. Provide material as approved by Soils Engineer for filling and backfilling outside of structures.
   3. Fill and backfill placement:
      a. Prior to placing fill and backfill material, obtain optimum moisture and maximum density properties for proposed material from Soils Engineer.
      b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
      c. Compact material with equipment of proper type and size to obtain density specified.
      d. Use only hand operated equipment for filling and backfilling next to walls and retaining walls.
      e. Do not place fill or backfill material when temperature is less than 40 DegF and when subgrade to receive material is frozen, wet, loose, or soft.
      f. Use vibratory equipment for compacting granular material; do not use water.
   4. Backfilling against walls:
      a. Do not backfill around any part of structures until each part has reached specified 28-day compressive strength and backfill material has been approved.
      b. Do not start backfilling until concrete forms have been removed, trash removed from excavations, pointing of masonry work, concrete finishing, dampproofing and waterproofing have been completed.
      c. Do not place fills against walls until floor slabs at top, bottom, and at intermediate levels of walls are in place and have reached 28-day required compressive strength to prevent wall movement.
      d. Bring backfill and fill up uniformly around the structures and individual walls, piers, or columns.

E. Backfilling Outside of Structures Under Piping or Paving:
   1. When backfilling outside of structures requires placing backfill material under piping or paving, the material shall be placed from bottom of excavation to underside of piping or paving at the density required for fill under piping or paving as indicated in this Specification Section.
2. This compacted material shall extend transversely to the centerline of piping or paving a horizontal distance each side of the exterior edges of piping or paving equal to the depth of backfill measured from bottom of excavation to underside of piping or paving.

3. Provide special compacted bedding or compacted subgrade material under piping or paving as required by other Specification Sections for the Project.

3.7 SPECIAL REQUIREMENTS

A. Erosion Control:

1. Conduct work to minimize erosion of site.

2. Construct stilling areas to settle and detain eroded material.

3. Remove eroded material washed off site.

4. Clean streets daily of any spillage of dirt, rocks or debris from equipment entering or leaving site.

END OF SECTION
SECTION 02221
TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavation, trenching, backfilling and compacting for all underground utilities.

B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 02200 - Earthwork.
4. Section 03002 - Concrete.
5. Division 16 - Electrical.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
1. ASTM International (ASTM):
   b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using
      Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
   c. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil
      Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
   d. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for
      Sewers and Other Gravity-Flow Applications.
   e. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils
      Using a Vibratory Table.
   f. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils
      and Calculation of Relative Density.

B. Qualifications: Hire an independent soils laboratory to conduct in-place moisture-density tests
for backfilling to assure that all work complies with this Specification Section.

1.3 DEFINITIONS

A. Excavation: All excavation will be defined as unclassified.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01340 for requirements for the mechanics and administration of
   the submittal process.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
3. Submit respective pipe or conduit manufacturer's data regarding bedding methods of
   installation and general recommendations.
4. Submit sieve analysis reports on all granular materials.

B. Informational Submittals:
1. See Specification Section 01340 for requirements for the mechanics and administration of
   the submittal process.
2. Trench shield (trench box) certification if employed:
   a. Specific to Project conditions.
   b. Re-certified if members become distressed.
   c. Certification by registered professional structural engineer, registered in the state where
      the Project is located.
   d. Engineer is not responsible to, and will not, review and approve.

1.5 PROJECT CONDITIONS

A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent
   slides or caving.
   1. Maintain and trim excavated materials in such manner to be as little inconvenience as
      possible to public and adjoining property owners.
   2. Provide full access to public and private premises and fire hydrants, at street crossings,
      sidewalks and other points as designated by Owner to prevent serious interruption of travel.
   C. Protect and maintain bench marks, monuments or other established points and reference points
      and if disturbed or destroyed, replace items to full satisfaction of Owner and controlling agency.
   D. Verify location of existing underground utilities.

PART 2 - PRODUCTS

2.1 MATERIALS

   A. Backfill Material:
      1. As approved by Engineer.
         a. Free of rock cobbles, roots, sod or other organic matter, and frozen material.
         b. Moisture content at time of placement: 3 percent plus/minus of optimum moisture
            content as specified in accordance with ASTM D698.
      2. The clay backfill shall consist of lean clay soils or sandy lean clay soils. The sand backfill
         shall consist of free-draining sand.
         a. If sand soils are selected as backfill, the zone of the sand backfill should extend a
            minimum of 2 feet outside the bottom of the foundation and then extend upward and
            outward at a slope no steeper than 1:1 (horizontal to vertical). If sand soils are used, we
            cap the sand backfill section with 2 feet of clayey soil in areas that will not have asphalt
            concrete or concrete surfacing to minimize infiltration of surface waters.

   B. Material Types
      1. Structural Fill
         a. The structural fill should consist of a pit-run or processed sand or gravel having a
            maximum particle size of 3 inches with less than 15 percent by weight passing the #200
            sieve. The structural fill should be placed in lifts of up to 1 foot in thickness. The on-
            site coarse alluvium soils could be used as structural fill.
      2. Drainage Rock
         a. The drainage rock should be crushed, washed and have 100 percent by weight passing
            the 1-inch sieve and no more than 5 percent by weight passing the #4 sieve.
      3. Clay Backfill
         a. The clay backfill should consist of a non-organic clay having a liquid limit less than 45.
            Scrutiny on the clay material’s moisture content should be made prior to the acceptance
            and use. The clay backfill should be placed in lifts of up to 6 inches in thickness. The
            on-site existing fill materials should not be used as backfill due to the presence of
            construction debris.
      4. Free-Draining Sand
         a. The free-draining sand should contain no more than 5 percent by weight passing the
            #200 sieve. The free-draining sand should be placed in lifts of up to 1 foot in thickness.
C. Recommended Moisture Levels
1. The moisture content of the clay backfill materials, when used as backfill around the exterior of a foundation should be maintained within a range of plus 1 percent to minus 4 percent of the materials’ optimum moisture content.
2. When the clay backfill materials are used below a pavement area, or as site grading, the materials’ moisture content should be maintained within a range minus 1 percent to minus 4 percent of the materials’ optimum moisture content. The optimum moisture content should be determined using a standard Proctor (ASTM: D698) test.
3. The moisture content of the granular backfill materials should be maintained at a level that will be conducive for vibratory compaction.

D. Bedding Materials:
1. As approved by the Soils Engineer.
2. Granular bedding materials:
   a. STM C33, gradation 67 (3/4 IN to No. 4 sieve) defined below:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>1 IN</th>
<th>3/4 IN</th>
<th>3/8 IN</th>
<th>No. 4</th>
<th>No. 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Passing by Weight</td>
<td>100</td>
<td>90-100</td>
<td>20-55</td>
<td>0-10</td>
<td>0</td>
</tr>
</tbody>
</table>

1) Well graded gravel.
2) Flowable fill:
   a. Description: Flowable fill shall be a mixture of cement, fly ash, fine sand, water, and air having a consistency which will flow under a very low head.
   b. Material characteristics:
      1) The approximate quantities of each component per cubic yard of mixed material shall be as follows:
         a) Cement (Type I or II): 50 LBS.
         b) Fly ash: 200 LBS.
         c) Fine sand: 2,700 LBS.
         d) Water: 420 LBS.
         e) Air content: 10 percent.
      2) Actual quantities shall be adjusted to provide a yield of 1 cubic yard with the materials used.
      3) Approximate compressive strength should be 85 to 175 psi.
      4) Fine sand shall be an evenly graded material having not less than 95 percent passing the No. 4 sieve and not more than 5 percent passing the No. 200 sieve.

PART 3 - EXECUTION

3.1 GENERAL

A. Remove and dispose of unsuitable materials as directed by Soils Engineer to site provided by Contractor.

3.2 EXCAVATION

A. Unclassified Excavation: Remove rock excavation, clay, silt, gravel, hard pan, loose shale, and loose stone as directed by Soils Engineer.

B. Excavation for Appurtenances:
   1. 12 IN (minimum) clear distance between outer surface and embankment.
   2. See Specification Section 02200 for applicable requirements.
C. Groundwater Dewatering:
   1. Where groundwater is, or is expected to be, encountered during excavation, install a
dewatering system to prevent softening and disturbance of subgrade to allow subgrade
stabilization, pipe, bedding and backfill material to be placed in the dry, and to maintain a
stable trench wall or side slope.
   2. Groundwater shall be drawn down and maintained at least 3 FT below the bottom of any
trench or manhole excavation prior to excavation.
   3. Review soils investigation before beginning excavation and determine where groundwater is
likely to be encountered during excavation.
      a. Employ dewatering specialist for selecting and operating dewatering system.
   4. Keep dewatering system in operation until dead load of pipe, structure and backfill exceeds
possible buoyant uplift force on pipe or structure.
   5. Dispose of groundwater to an area which will not interfere with construction operations or
damage existing construction.
   6. Install groundwater monitoring wells as necessary.
   7. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might
weaken the subgrade.

D. Trench Excavation:
   1. Excavate trenches by open cut method to depth shown on Drawings and necessary to
accommodate work.
      a. Support existing utility lines and yard piping where proposed work crosses at a lower
elevation.
         1) Stabilize excavation to prevent undermining of existing utility and yard piping.
   2. Open trench outside buildings, units, and structures:
      a. No more than the distance between two manholes, structures, units, or 300 LF,
         whichever is less.
      b. Field adjust limitations as weather conditions dictate.
   3. Trenching within buildings, units, or structures:
      a. No more than 100 LF at any one time.
   4. Any trench or portion of trench, which is opened and remains idle for seven (7) calendar
days, or longer, as determined by the Owner, may be directed to be immediately refilled,
without completion of work, at no additional cost to Owner.
      a. Said trench may not be reopened until Owner is satisfied that work associated with
         trench will be prosecuted with dispatch.
   5. Observe following trenching criteria:
      a. Trench size:
         1) Excavate width to accommodate free working space.
         2) Maximum trench width at top of pipe or conduit may not exceed outside diameter
of utility service by more than the following dimensions:

<table>
<thead>
<tr>
<th>OVERALL DIAMETER OF UTILITY SERVICE</th>
<th>EXCESS DIMENSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>33 IN and less</td>
<td>18 IN</td>
</tr>
<tr>
<td>more than 33 IN</td>
<td>24 IN</td>
</tr>
</tbody>
</table>
         3) Cut trench walls vertically from bottom of trench to 1 FT above top of pipe,
         conduit, or utility service.
         4) Keep trenches free of surface water runoff.
            a) Include cost in Bid.
            b) No separate payment for surface water runoff pumping will be made.

E. Trenching for Electrical Installations:
   1. Observe the preceding Trench Excavation paragraph in PART 3 of this Specification
Section.
2. Modify for electrical installations as follows:
   a. Open no more than 600 LF of trench in exterior locations for trenches more than 12 IN but not more than 30 IN wide.
   b. Any length of trench may be opened in exterior locations for trenches which are 12 IN wide or less.
   c. Do not over excavate trench.
   d. Cut trenches for electrical runs with minimum 30 IN cover, unless otherwise specified or shown on Drawings.
   e. See Division 16 for additional requirements.

F. Flowable Fill:
   1. Flowable fill shall be:
      a. Discharged from a mixer by any means acceptable to the Engineer into the area to be filled.
      b. Placed in 4 FT maximum lifts to the elevations indicated.
         1) Allow 12 HR set-up time before placing next lift or as approved by the Engineer.
         2) Contractor shall place flowable fill lifts in such a manner as to prevent flotation of the pipe.
   2. Flowable fill shall not be placed on frozen ground.
   3. Subgrade on which flowable fill is placed shall be free of disturbed or softened material and water.
   4. Conform to appropriate requirements of Specification Section 02200.
   5. Flowable fill batching, mixing, and placing may be started if weather conditions are favorable, and the air temperature is 34 DegF and rising.
   6. At the time of placement, flowable fill must have a temperature of at least 40 DegF.
   7. Mixing and placing shall stop when the air temperature is 38 DegF or less and falling.
   8. Each filling stage shall be as continuous an operation as is practicable.
   9. Contractor shall prevent traffic contact with flowable fill for at least 24 HRS after placement or until flowable fill is hard enough to prevent rutting by construction equipment.
   10. Flowable fill shall not be placed until water has been controlled or groundwater level has been lowered in conformance with the requirements of the preceding Groundwater Dewatering paragraph in PART 3 of this Specification Section.

3.3 PREPARATION OF FOUNDATION FOR PIPE LAYING

A. Over-Excavation:
   1. Backfill and compact to 90 percent of maximum dry density per ASTM D698.
   2. Backfill with granular bedding material as option.

B. Rock Excavation:
   1. Excavate minimum of 6 IN below bottom exterior surface of the pipe or conduit.
   2. Backfill to grade with suitable earth or granular material.
   3. Form bell holes in trench bottom.

C. Subgrade Stabilization:
   1. Stabilize the subgrade when directed by the Owner.
   2. Observe the following requirements when unstable trench bottom materials are encountered.
      a. Notify Owner when unstable materials are encountered.
         1) Define by drawing station locations and limits.
         2) Remove unstable trench bottom caused by Contractor failure to dewater, rainfall, or Contractor operations.
            1) Replace with subgrade stabilization with no additional compensation.

3.4 BACKFILLING METHODS

A. Do not backfill until tests to be performed on system show system is in full compliance to specified requirements.
B. Carefully Compacted Backfill:
   1. Furnish where indicated on Drawings, specified for trench embedment conditions and for
      compacted backfill conditions up to 12 IN above top of pipe or conduit.
   2. Comply with the following:
      a. Place backfill in lifts not exceeding 8 IN (loose thickness).
      b. Hand place, shovel slice, and pneumatically tamp all carefully compacted backfill.
      c. Observe specific manufacturer's recommendations regarding backfilling and
         compaction.
      d. Compact each lift to specified requirements.

C. Common Trench Backfill:
   1. Perform in accordance with the following:
      a. Place backfill in lift thicknesses capable of being compacted to densities specified.
      b. Observe specific manufacturer's recommendations regarding backfilling and
         compaction.
      c. Avoid displacing joints and appurtenances or causing any horizontal or vertical
         misalignment, separation, or distortion.

D. Water flushing for consolidation is not permitted.

E. Backfilling for Electrical Installations:
   1. Observe the preceding Carefully Compacted Backfill paragraph or Common Trench
      Backfill paragraph in PART 3 of this Specification Section or when approved by the
      Engineer.
   2. Modify for electrical installation as follows:
      a. Observe notes and details on electrical drawings for fill in immediate vicinity of direct
         burial cables.

3.5 COMPACTION

A. General:
   1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of
      compaction than undisturbed materials adjacent to the work.
   2. In no case shall degree of compaction below minimum compactions specified be accepted.

B. Compaction Requirements:
   1. Unless noted otherwise on Drawings or more stringently by other Specification Sections,
      comply with following minimum trench compaction criteria.
   2. Recommended Compaction Levels
      a. The recommended compaction levels listed below are based on a material’s
         maximum dry density value, as determined by a standard Proctor (ASTM D698) test.

<table>
<thead>
<tr>
<th>Placement Location</th>
<th>Compaction Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below Foundations</td>
<td>97%</td>
</tr>
<tr>
<td>Exterior Wall Backfill (Below-Grade)</td>
<td>95% - 98%</td>
</tr>
<tr>
<td>Subgrade Below Pavement Areas</td>
<td>95%</td>
</tr>
<tr>
<td>Base Course Below Pavement Areas</td>
<td>97%</td>
</tr>
<tr>
<td>Non-Structural Areas</td>
<td>90%</td>
</tr>
</tbody>
</table>

3.6 FIELD QUALITY CONTROL

A. Testing:
   1. Perform in-place moisture-density tests as directed by the Owner.
   2. Perform tests through recognized testing laboratory approved by Owner.
   3. Costs of "Passing" tests paid by Owner.
4. Perform additional tests as directed until compaction meets or exceeds requirements.
5. Cost associated with "Failing" tests shall be paid by Contractor.
6. Reference to Engineer in this Specification Section will imply Soils Engineer when employed by Owner and directed by Engineer to undertake necessary inspections as approvals as necessary.
7. Assure Owner has immediate access for testing of all soils related work.
8. Ensure excavations are safe for testing personnel.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Topsoiling and finished grading.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 02110 - Site Clearing.
   4. Section 02200 - Earthwork.
   5. Section 02270 - Soil Erosion and Sediment Control.

C. Location of Work: All areas within limits of grading and all areas outside limits of grading which are disturbed in the course of the work.

1.2 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Project Data: Test reports for furnished topsoil.

1.3 SITE CONDITIONS

A. Verify amount of topsoil stockpiled and determine amount of additional topsoil, if necessary to complete work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil:
   1. Original surface soil typical of the area.
   2. Existing topsoil stockpiled under Specification Section 02110.
   3. Capable of supporting native plant growth.

2.2 TOLERANCES

A. Finish Grading Tolerance: 0.1 FT plus/minus from required elevations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Correct, adjust and/or repair rough graded areas.
   1. Cut off mounds and ridges.
   2. Fill gullies and depressions.
   3. Perform other necessary repairs.
4. Bring all sub-grades to specified contours, even and properly compacted.

B. Loosen surface to depth of 2 IN, minimum.

C. Remove all stones and debris over 2 IN in any dimension.

3.2 ROUGH GRADE REVIEW

A. Reviewed by Engineer in Specification Section 02110.

3.3 PLACING TOPSOIL

A. Do not place when subgrade is wet or frozen enough to cause clodding.

B. Spread to compacted depth of 6 IN for all disturbed earth areas.

C. If topsoil stockpiled is less than amount required for work, furnish additional topsoil at no cost to Owner.

D. Provide finished surface free of stones, sticks, or other material 1 IN or more in any dimension.

E. Provide finished surface smooth and true to required grades.

F. Restore stockpile area to condition of rest of finished work.

3.4 ACCEPTANCE

A. Upon completion of topsoiling, obtain Engineer's acceptance of grade and surface.

B. Make test holes where directed to verify proper placement and thickness of topsoil.

END OF SECTION
SECTION 02270
SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Soil erosion and sediment control.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Erosion control standards: Standards and Specifications for Soil Erosion and Sediment Control in Developing Areas by the United States Department of Agriculture (USDA), Soil Conservation Service, College Park, Maryland.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Straw bales, twine tied.
B. Pipe Riser and Barrel: 16 GA corrugated metal pipe (CMP) of size indicated.
C. Stone for Stone Filter: 2 IN graded gravel or crushed stone.
D. Grass Seed: Annual ryegrass.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to General Stripping Topsoil and Excavating:
   1. Install perimeter dikes and swales.
   2. Excavate and shape sediment basins and traps.
   3. Construct pipe spillways and install stone filter where required.
   4. Machine compact all berms, dikes and embankments for basins and traps.
   5. Install straw bales where indicated.
      a. Provide two stakes per bale.
      b. First stake angled toward previously installed bale to keep ends tight against each other.

B. Construct sediment traps where indicated on Drawings during rough grading as grading progresses.

C. Temporarily seed basin slopes and topsoil stockpiles:
   1. Rate: 1/2 LB/1000 SF.
   2. Reseed as required until good stand of grass is achieved.
3.2 DURING CONSTRUCTION PERIOD

A. Maintain Basins, Dikes, Traps, Stone Filters, Straw Bales, etc.:
   1. Inspect regularly especially after rainstorms.
   2. Repair or replace damaged or missing items.

B. After rough grading, sow temporary grass cover over all exposed earth areas not draining into sediment basin or trap.

C. Construct inlets as soon as possible.
   1. Excavate and tightly secure straw bales completely around inlets as detailed on Drawings.

D. Provide necessary swales and dikes to direct all water towards and into sediment basins and traps.

E. Do not disturb existing vegetation (grass and trees).

F. Excavate sediment out of basins and traps when capacity has been reduced by 50 percent.
   1. Remove sediment from behind bales to prevent overtopping.

G. Topsoil and Fine Grade Slopes and Swales, etc. Seed and mulch as soon as areas become ready.

3.3 NEAR COMPLETION OF CONSTRUCTION

A. Eliminate basins, dikes, traps, etc.

B. Grade to finished or existing grades.

C. Fine grade all remaining earth areas, then seed and mulch.

END OF SECTION
SECTION 02513
ASPHALTIC CONCRETE VEHICULAR PAVING

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Asphaltic concrete vehicular paving.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE
A. Referenced Standards:
   1. Construction standards: State of South Dakota, Department of Transportation, as amended
to date.
B. Miscellaneous:
   1. Should conflicts arise between standard specifications of government agencies mentioned
      herein and Contract Documents, Contract Documents shall govern.

1.3 SUBMITTALS
A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer’s installation instructions.
   3. Asphalt design mix.

PART 2 - PRODUCTS

2.1 MATERIALS
A. See Part 3.

2.2 MIXES
A. See Part 3.

PART 3 - EXECUTION

3.1 APPLICATION
A. Construct to line, grade and section as shown on Drawings and in accordance with referenced
State Specifications.
B. Aggregate Base Course:
   1. Scarify and recompact to a depth of 8 IN below the base course.
   2. Provide in accordance with SDDOT Standard Specifications Section 260.
      a. Both materials shall meet requirements set forth in SDDOT Standard Specifications
      Section 882.
3. Both the gravel cushion and aggregate base course shall be compacted with pneumatic rollers and shall continue on each lift of the base course until the surface is firm and unyielding, and attains at density of 97 percent of the maximum dry density as determined by SD 104, Method 4 and SD 105 or SD 114.

C. Asphaltic Concrete Composite:

1. Placement of asphalt shall be by self-propelled pavers. Compaction of the asphalt concrete shall be by methods and equipment satisfactory to the Engineer. Compaction of asphalt concrete shall be by the specified density method. The minimum density requirement is 92 percent (Rice Method) of specified density or to the satisfaction of the Engineer.

2. Asphalt concrete composite shall conform to the SDDOT Specifications for Class G Asphalt Concrete. The top lift shall conform to Class G-2 for the mineral aggregate specifications. All lower lift(s) shall conform to Class G-1 for the mineral aggregate specifications unless otherwise noted or by direction of the Engineer. The surface course shall not exceed 2 IN in thickness when laid and compacted. Lower lift(s) shall not exceed 3 IN in thickness when laid and compacted.

3. A maximum of 20 percent (by weight) of Recycled Asphalt Pavement (RAP) will be allowed in the asphalt concrete composite mix. RAP stockpiles containing concrete chunks, grass, dirt, wood, metal, coal tar, or other foreign or environmentally restricted materials shall not be used. No other recycled material will be allowed.

4. The asphalt cement used in the mixture shall be Performance Graded AASHTO Designation PG58-28 and shall conform to the current SDDOT Specifications. Certificates of compliance will be required on the performance graded asphalt binder. The supplier shall furnish a job mix formula for approval prior to asphalt production. All job mix designs shall have a laboratory designation number that can be printed on all weight tickets that correspond to the type of asphalt concrete mix. The Engineer may accept the mixture on the basis of the certificate of compliance, job mix formula and visual inspection or may test the mixture for specification compliance.

5. Tack coat (SS-1h or CSS-1h) shall be applied between each lift of asphalt and along existing concrete and asphalt faces and any areas as determined by the Engineer at the rate of 0.05 GAL/SQ YD.

6. Intermediate and/or top lifts shall not be placed until the underlying layer has cooled to 174 DegF or below. Also, if the contractor’s paving operation is damaging the underlying asphalt, paving shall be suspended until the asphalt can withstand the paving operation or and alternate paving operation which does not cause damage is determined.

7. Longitudinal Joints:
   a. Rollin operations for confined edges, the first pass adjacent to the confined edge, the compaction equipment shall be entirely on the hot mat 6 IN from the longitudinal joint.
   b. Rolling operations for un-confined edges, the compaction equipment shall extend 6 IN beyond the edge of the mat.
   c. Longitudinal joints of succeeding lifts shall be offset approximately 6 IN.
   d. Longitudinal joints should be on the lane lines in the top lift. A paving plan will be required from the Contractor.

8. Seasonal Limitations:
   a. Asphalt Concrete Composite will not be laid if the underlying surface is wet or frozen.
   b. Temperature for lower lifts shall be, at minimum 35 DegF, with a forecast of holding or rising temperatures.
   c. Temperatures for top lift shall be, at a minimum, 40 DegF, with a forecast of holding or rising temperatures.
   d. The Engineer may require tarping of loads during cool or windy conditions.

END OF SECTION
SECTION 02930
SEEDING, SODDING AND LANDSCAPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Seeding, sodding and landscape planting:
      a. Soil preparation.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 02260 - Topsoiling and Finished Grading.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
      a. Z60.1, American Standard for Nursery Stock.
   2. AOAC International (AOAC).
   3. ASTM International (ASTM):
      b. D5276, Standard Test Method for Drop Test of Loaded Containers by Free Fall.

B. Quality Control:
   1. Fertilizer:
      a. If Engineer determines fertilizer requires sampling and testing to verify quality, testing will be done at Contractor's expense, in accordance with current methods of the AOAC.
      b. Upon completion of Project, a final check of total quantities of fertilizer used will be made against total area seeded.
      c. If minimum rates of application have not been met, Contractor will be required to distribute additional quantities to make up minimum application specified.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Layout drawings:
      a. Scaled site plan (scale 1 IN = 20 FT or equal to scale of Project site plan Drawing) on reproducible Drawing to show:
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Signed copies of vendor's statement for seed mixture required, stating botanical and common name, place of origin, strain, percentage of purity, percentage of germination, and amount of Pure Live Seed (PLS) per bag.
      d. Type of herbicide to be used during first growing season to contain annual weeds and application rate.
   4. Certification that each container of seed delivered will be labeled in accordance with Federal and State Seed Laws and equals or exceeds Specification requirements.
B. Informational Submittals:
1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Copies of invoices for fertilizer used on Project showing grade furnished, along with certification of quality and warranty.

1.4 SEQUENCING AND SCHEDULING

A. Installation Schedule:
1. Show schedule of when lawn type and other grass areas are anticipated to be planted.
2. Indicate planting schedules in relation to schedule for irrigation system installation, finish grading and topsoiling.
3. Indicate anticipated dates Engineer will be required to review installation for initial acceptance and final acceptance.

B. Pre-installation Meeting:
1. Meet with Engineer and other parties as necessary to discuss schedule and methods, unless otherwise indicated by Engineer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND SUPPLIERS

A. Subject to compliance with the Contract Documents, the manufacturers and suppliers listed in the applicable Articles below are acceptable.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. Seed all disturbed areas.

B. Seed Quality:
1. Fresh, clean, new-crop seed labeled in accordance with USDA Rules and Regulations under the Federal Seed Act in effect on date of bidding.
2. Provide seed of species, proportions, and minimum percentages of purity, germination and maximum percentage of weed seed as specified.
3. Approval of all seed for use shall be based on the accumulative total of PLS specified for each phase of work.

C. Lawn-Type Seed Mixture:

<table>
<thead>
<tr>
<th>BOTANICAL AND COMMON NAME</th>
<th>PERCENT BY WEIGHT (PLS)</th>
<th>MINIMUM PERCENT GERMINATION</th>
<th>MINIMUM PERCENT PURITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kentucky Bluegrass (Poa pratensis)</td>
<td>60</td>
<td>85</td>
<td>95</td>
</tr>
<tr>
<td>Fescue, Tall, KY 31 (Festura arundiancea 'KY 31')</td>
<td>30</td>
<td>85</td>
<td>98</td>
</tr>
<tr>
<td>Ryegrass, Perennial (Lolium perenne)</td>
<td>10</td>
<td>90</td>
<td>95</td>
</tr>
</tbody>
</table>

D. Water:
1. Water free from substances harmful to grass or sod growth.
2. Provide water from source approved prior to use.
PART 3 - EXECUTION

3.1 SOIL PREPARATION

A. General:
   1. Limit preparation to areas which will be planted soon after.
   2. Provide facilities to protect and safeguard all persons on or about premises.
   3. Protect existing trees designated to remain.
   4. Verify location and existence of all underground utilities.
      a. Take necessary precaution to protect existing utilities from damage due to construction activity.
      b. Repair all damages to utility items at sole expense.
   5. Provide facilities such as protective fences and/or watchmen to protect work from vandalism.
      a. Contractor to be responsible for vandalism until acceptance of work in whole or in part.

B. Preparation for Lawn-Type Seeding:
   1. Loosen surface to minimum depth of 4 IN.
   2. Remove stones over 1 IN in any dimension and sticks, roots, rubbish, and other extraneous matter.
   3. Prior to applying fertilizer, loosen areas to be seeded with a double disc or other suitable device if the soil has become hard or compacted.
   4. Correct any surface irregularities in order to prevent pocket or low areas which will allow water to stand.
   5. Distribute fertilizer uniformly over areas to be seeded:
      a. For lawn-type seeding: 30 LBS per 1000 SF.
      b. For pasture seeding: 200 LBS per acre.
   6. Incorporate fertilizer into soil to a depth of at least 2 IN by diskimg, harrowing, or other approved methods.
   7. Remove stones or other substances from surface which will interfere with turf development or subsequent mowing operations.
   8. Grade lawn areas to a smooth, even surface with a loose, uniformly fine texture.
      a. Roll and rake, remove ridges and fill depressions, as required to meet finish grades.
      b. Limit fine grading to areas which can be planted soon after preparation.
   9. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and before planting.

3.2 INSTALLATION

A. Lawn-Type Seeding:
   1. Do not use seed which is wet, moldy, or otherwise damaged.
   2. Perform seeding work from April 20 to May 15 for spring planting, and August 1 to September 15 for fall planting, unless otherwise approved by Engineer.
   3. Employ satisfactory methods of sowing using mechanical power-driven drills or seeders, or mechanical hand seeders, or other approved equipment.
   4. Distribute seed evenly over entire area at rate of application not less than 4 LBS (PLS) of seed per 1000 SF, 50 percent sown in one direction, remainder at right angles to first sowing.
   5. Stop work when work extends beyond most favorable planting season for species designated, or when satisfactory results cannot be obtained because of drought, high winds excessive moisture, or other factors.
      a. Resume work only when favorable conditions develop.
   6. Lightly rake seed into soil followed by light rolling or cultipacking.
   7. Immediately protect seeded areas against erosion by mulching.
      a. Spread mulch in continuous blanket using 1-1/2 tons per acre to a depth of 4 or 5 straws.
8. Protect seeded slopes against erosion with erosion netting or other methods approved by Engineer.
   a. Protect seeded areas against traffic or other use by erecting barricades and placing warning signs.
9. Immediately following spreading mulch, anchor mulch using a rolling coulter or a wheatland land packer having wheels with V-shaped edges to force mulch into soil surface, or apply evenly distributed emulsified asphalt at rate of 10-13 GAL/1000 SF.
   a. SS-1 emulsion in accordance with ASTM D5276 or RC-1 cutback asphalt in accordance with ASTM D2028 are acceptable.
   b. If mulch and asphalt are applied in one treatment, use SS-1 emulsion with penetration test range between 150-200.
   c. Use appropriate shields to protect adjacent site improvements.

3.3 PLANTING GROUND COVERS

A. Planting Season:
   1. Plant ground covers between March 15 to June 1, September 1 to October 15.

3.4 MAINTENANCE AND REPLACEMENT

A. General:
   1. Begin maintenance of planted areas immediately after each portion is planted and continue until final acceptance or for a specific time period as stated below, whichever is the longer.
   2. Provide and maintain temporary piping, hoses, and watering equipment as required to convey water from water sources and to keep planted areas uniformly moist as required for proper growth.
   3. Protection of new materials:
      a. Provide barricades, coverings or other types of protection necessary to prevent damage to existing improvements indicated to remain.
      b. Repair and pay for all damaged items.
   4. Replace unacceptable materials with materials and methods identical to the original specifications unless otherwise approved by the Engineer.

B. Seeded or Sodded Lawns:
   1. Maintain seeded lawns: 90 days, minimum, after installation and review of entire project area to be planted.
   2. Maintenance period begins at completion of planting or installation of entire area to be seeded or sodded.
   3. Engineer will review seeded or sodded lawn area after installation for initial acceptance.
   4. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth, uniform lawn, free of weeds and eroded or bare areas.
   5. Lay out temporary lawn watering system and arrange watering schedule to avoid walking over muddy and newly seeded areas.
      a. Use equipment and water to prevent puddling and water erosion and displacement of seed or mulch.
   6. Mow lawns as soon as there is enough top growth to cut with mower set at recommended height for principal species planted.
      a. Repeat mowing as required to maintain height.
      b. Do not delay mowing until grass blades bend over and become matted.
      c. Do not mow when grass is wet.
      d. Time initial and subsequent mowings as required to maintain a height of 1-1/2 to 2 IN.
      e. Do not mow lower than 1-1/2 IN.
   7. Remulch with new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose.
      a. Anchor as required to prevent displacement.
8. Unacceptable plantings are those areas that do not meet the quality of the specified material, produce the specified results, or were not installed to the specified methods.

9. Replant bare areas using same materials specified.

10. Engineer will review final acceptability of installed areas at end of maintenance period.

11. Maintain repaired areas until remainder of maintenance period or approved by Engineer, whichever is the longer period.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cast-in-place concrete and grout.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 03348 - Concrete Finishing and Repair of Surface Defects.
   4. Section 03431 - Precast and Prestressed Concrete.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
   a. 116R, Cement and Concrete Terminology.
   b. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass
      Concrete.
   c. 212.3R, Chemical Admixtures for Concrete.
   d. 304R, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
   e. 304.2R, Placing Concrete by Pumping Methods.
   f. 305R, Hot Weather Concreting.
   g. 306R, Cold Weather Concreting.
   h. 318, Building Code Requirements for Structural Concrete.
   i. 347, Guide to Formwork for Concrete.

2. ASTM International (ASTM):
   a. A185, Standard Specification for Steel Welded Wire Reinforcement, Plain, for
      Concrete.
   b. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete
      Reinforcement.
   c. A1064, Standard Specification for Steel Wire and Welded Wire Replacement, Plain and
      Deformed, for Concrete.
   d. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   e. C33, Standard Specification for Concrete Aggregates.
   f. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete
      Specimens.
   h. C138, Standard Method of Test for Density (Unit Weight), Yield, and Air Content
      (Gravimetric) of Concrete.
   k. C172, Standard Practice for Sampling Freshly Mixed Concrete.
   l. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the
      Volumetric Method.
   m. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the
      Pressure Method.
   o. C289, Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates
      (Chemical Method).
      Concrete.

r. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

s. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).


3. Corps of Engineers (COE):


B. Quality Control:

1. Concrete testing agency:
   a. Contractor to employ and pay for services of a testing laboratory to:
      1) Perform materials evaluation.
      2) Design concrete mixes.
   b. Concrete testing agency to meet requirements of ASTM E329.

2. Do not begin concrete production until proposed concrete mix design has been approved by Engineer.
   a. Approval of concrete mix design by Engineer does not relieve Contractor of his responsibility to provide concrete that meets the requirements of this Specification.

3. Adjust concrete mix designs when material characteristics, job conditions, weather, strength test results or other circumstances warrant.
   a. Do not use revised concrete mixes until submitted to and approved by Engineer.

C. Qualifications: Ready mixed concrete batch plant certified by NRMCA.

1.3 DEFINITIONS

A. Per ACI 116R except as modified herein:


2. Concrete Testing Agency: Testing agency employed to perform materials evaluation, design of concrete mixes or testing of concrete placed during construction.

3. Exposed concrete: Exposed to view after construction is complete.


5. Nonexposed concrete: Not exposed to view after construction is complete.


7. Specified strength: Specified compressive strength at 28 days.

8. Submitted: Submitted to Engineer.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.

2. Concrete mix designs proposed for use.
   a. Concrete mix design submittal to include the following information:
      1) Sieve analysis and source of fine and coarse aggregates.
      2) Test for aggregate organic impurities.
      3) Test for deleterious aggregate per ASTM C289.
      4) Proportioning of all materials.
      5) Type of cement with mill certificate for cement.
      6) Type of fly ash with certificate of conformance to specification requirements.
1. Slump.
2. Air content.
3. Brand, type, ASTM designation, and quantity of each admixture proposed for use.
4. 28-day cylinder compressive test results of trial mixes per ACI 318 and as indicated herein.
5. Standard deviation value for concrete production facility.

3. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Manufacturers and types:
      1) Joint fillers.
      2) Curing agents.
      3) Construction joint bonding adhesive.
      4) Nonshrink grout with cure/seal compound.
      5) Waterstops.

4. Reinforcing steel:
   a. Show grade, sizes, number, configuration, spacing, location and all fabrication and placement details.
   b. In sufficient detail to permit installation of reinforcing without having to make reference to Contract Drawings.
   c. Obtain approval of Shop Drawings by Engineer before fabrication.
   d. Mill certificates.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Storage of Material:
   1. Cement and fly ash:
      a. Store in moistureproof, weathertight enclosures.
      b. Do not use if caked or lumpy.
   2. Aggregate:
      a. Store to prevent segregation and contamination with other sizes or foreign materials.
      b. Obtain samples for testing from aggregates at point of batching.
      c. Do not use frozen or partially frozen aggregates.
      d. Do not use bottom 6 IN of stockpiles in contact with ground.
      e. Allow sand to drain until moisture content is uniform prior to use.
   3. Admixtures:
      a. Protect from contamination, evaporation, freezing, or damage.
      b. Maintain within temperature range recommended by manufacturer.
      c. Completely mix solutions and suspensions prior to use.
   4. Reinforcing steel: Support and store all rebars above ground.

B. Delivery:
   1. Concrete:
      a. Prepare a delivery ticket for each load for ready-mixed concrete.
      b. Truck operator shall hand ticket to Owner's Representative at the time of delivery.
      c. Ticket to show:
         1) Mix identification mark.
         2) Quantity delivered.
         3) Amount of each material in batch.
         4) Outdoor temp in the shade.
         5) Time at which cement was added.
         6) Numerical sequence of the delivery.
         7) Total amount of water.
   2. Reinforcing steel:
      a. Ship to jobsite with attached plastic or metal tags with permanent mark numbers.
      b. Mark numbers to match Shop Drawing mark number.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:

1. Nonshrink, nonmetallic grout:
   a. Sika "SikaGrout 212."
   b. Euclid Chemical "NS Grout."
   c. BASF Admixtures, Inc. "Masterflow 713."

2. Expansion joint fillers:
   a. Permaglaze Co.
   b. Rubatex Corp.
   c. Williams Products, Inc.

3. Waterstops, Preformed Strip Type:
   a. Acceptable manufacturers:
      1) Hydrotite CJ by Greens Creek Products, Inc.
      2) Adeka Ultra Seal USA.
   b. Materials:
      1) Hydrophilic type waterstop manufactured solely for the purpose of preventing water from traveling through construction joints.
      2) Hydrotite type CJ-0725-3K.

4. Form coating:
   a. Richmond "Rich Cote."
   b. Industrial Lubricants "Nox-Crete Form Coating."
   c. Euclid Chemical "Eucoslip VOX."

5. Prefabricated forms:
   a. Simplex "Industrial Steel Frame Forms."
   b. Symons "Steel Ply."
   c. Universal "Uniform."

6. Bonding agent:
   a. Euclid Chemical Co.
   b. BASF Admixtures, Inc.
   c. L&M Construction Chemicals Inc.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. Portland Cement: Conform to ASTM C150 Type I or ASTM C595 Type IP.

B. Fly Ash:
   1. ASTM C618, Class F.
   2. Nonstaining.
      a. Hardened concrete containing fly ash to be uniform light gray color.
   3. Maximum loss on ignition: 4 percent.
   4. Compatible with other concrete ingredients.
   5. Obtain proposed fly ash from a source approved by the State Highway Department in the state of South Dakota for use in concrete for bridges.
   6. Do not use for precast concrete.

C. Admixtures:
   2. Water reducing, retarding, and accelerating admixtures:
      a. ASTM C494 Type A through E.
      b. Conform to provisions of ACI 212.3R.
      c. Do not use retarding or accelerating admixtures unless specifically approved in writing by Engineer and at no cost to Owner.
      d. Follow manufacturer's instructions.
e. Use chloride free admixtures only.

3. Maximum total water soluble chloride ion content contributed from all ingredients of concrete including water, aggregates, cementitious materials and admixtures by weight percent of cement:
   a. 0.06 prestressed concrete.
   b. 0.10 all other concrete.

4. Do not use calcium chloride.

5. Pozzolanic admixtures: ASTM C618.

6. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.

D. Water: Potable, clean, free of oils, acids and organic matter.

E. Aggregates:
   1. Normal weight concrete: ASTM C33, except as modified below.
      a. Obtain proposed aggregates from a source approved by the State Highway Department in the state of South Dakota for use in concrete for bridges.
   2. Fine aggregate:
      a. Clean natural sand.
      b. No manufactured or artificial sand.
   3. Coarse aggregate:
      a. Crushed rock, natural gravel, or other inert granular material.
      b. Maximum amount of clay or shale particles: 1 percent.
   4. Gradation of coarse aggregate:
      a. Concrete topping: Size #7.
      b. All other concrete: Size #57 or #67.

F. Concrete Grout:
   1. Nonshrink, nonmetallic grout:
      a. Nonmetallic, noncorrosive, nonstaining, premixed with only water to be added.
      b. Grout to produce a positive but controlled expansion.
      c. Mass expansion not to be created by gas liberation.
      d. Minimum compressive strength of nonshrink grout at 28 days: 6500 psi.
      e. In accordance with COE CRD-C621.

G. Reinforcing Steel:
   1. Reinforcing bars: ASTM A615, Grade 60.
   2. Welded wire reinforcement:
      a. ASTM A185 or ASTM A1064.
      b. Minimum yield strength: 60,000 psi.

H. Forms:
   1. Prefabricated or job built.
   2. Wood forms:
      a. New 5/8 or 3/4 IN 5-ply structural plywood of concrete form grade.
      b. Built-in-place or prefabricated type panel.
      c. 4 x 8 FT sheets for built-in-place type except where smaller pieces will cover entire area.
      d. When approved, plywood may be reused.
   3. Metal forms:
      a. Metal forms excluding aluminum may be used.
      b. Forms to be tight to prevent leakage, free of rust and straight without dents to provide members of uniform thickness.
   5. Form ties:
      a. Removable end, permanently embedded body type with cones on outer ends not requiring auxiliary spreaders.
      b. Cone diameter: 3/4 IN minimum to 1 IN maximum.
c. Embedded portion 1-1/2 IN maximum back from concrete face.
d. If not provided with threaded ends, constructed for breaking off ends without damage to concrete.
6. Form release: Nonstaining and shall not prevent bonding of future finishes to concrete surface.

I. Chairs, Runners, Bolsters, Spacers, and Hangers:
1. Stainless steel, epoxy coated, or plastic coated metal.
   a. Plastic coated: Rebar support tips in contact with the forms only.

J. Membrane Curing Compound:
1. ASTM C309, Type I-D.
2. Resin based, dissipates upon exposure to UV light.
3. Curing compound shall not prevent bonding of any future coverings, coatings or finishes.
4. Curing compounds used in water treatment plant construction to be nontoxic and taste and odor free.

K. Bonding Agent:
1. High solids acrylic latex base liquid for interior or exterior application as a bonding agent to improve adhesion and mechanical properties of concrete patching mortars.
2. Euclid Chemical Co. "Flex-Con."
3. BASF Admixtures, Inc. "Acryl-Set."
4. L&M Construction Chemicals "Everbond."
5. Thoro System Products "Acryl 60."

L. Expansion Joint Filler:
1. In contact with water or sewage:
   a. Closed cell neoprene.
   b. ASTM D1056, Class SC (oil resistant and medium swell) of 2 to 5 psi compression deflection (Grade SCE41).
2. Exterior driveways, curbs and sidewalks:
   a. Asphalt expansion joint filler.
   b. ASTM D994.
3. Other use:
   a. Fiber expansion joint filler.
   b. ASTM D1751.

2.3 CONCRETE MIXES

A. General:
1. All concrete to be ready mixed concrete conforming to ASTM C94/C94M.
2. Provide concrete of specified quality capable of being placed without segregation and, when cured, of developing all properties required.
3. All concrete to be normal weight concrete

B. Strength:
1. Provide specified strength and type of concrete for each use in structure(s) as follows:

<table>
<thead>
<tr>
<th>TYPE</th>
<th>WEIGHT</th>
<th>SPECIFIED STRENGTH*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete fill</td>
<td>Normal weight</td>
<td>4000 psi</td>
</tr>
<tr>
<td>Concrete topping</td>
<td>Normal weight</td>
<td>4000 psi</td>
</tr>
<tr>
<td>Precast concrete</td>
<td>Normal weight</td>
<td>5000 psi</td>
</tr>
<tr>
<td>All other general use concrete</td>
<td>Normal weight</td>
<td>4000 psi</td>
</tr>
</tbody>
</table>

* Minimum 28-day compressive strength.
C. Air Entrainment:
   1. Provide air entrainment in all concrete resulting in a total air content percent by volume as follows:

<table>
<thead>
<tr>
<th>MAX AGGREGATE SIZE</th>
<th>TOTAL AIR CONTENT PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 IN or 3/4 IN</td>
<td>5 to 7</td>
</tr>
<tr>
<td>1/2 IN</td>
<td>5 1/2 to 8</td>
</tr>
</tbody>
</table>

2. Air content to be measured in accordance with ASTM C231, ASTM C173, or ASTM C138.

D. Slump - 4 IN maximum, 1 IN minimum:
   1. Measured at point of discharge of the concrete into the concrete construction member.
   2. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
   3. Pumped concrete:
      a. Provide additional water at batch plant to allow for slump loss due to pumping.
      b. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified above.
   4. Determine slump per ASTM C143.

E. Selection of Proportions:
   1. General:
      a. Proportion ingredients to:
         1) Produce proper workability, durability, strength, and other required properties.
         2) Prevent segregation and collection of excessive free water on surface.
   2. Minimum cement contents and maximum water cement ratios for concrete to be as follows:

<table>
<thead>
<tr>
<th>SPECIFIED STRENGTH</th>
<th>MINIMUM CEMENT, LB/CY</th>
<th>MAXIMUM WATER CEMENT RATIO BY WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>4000</td>
<td>611</td>
<td>0.45</td>
</tr>
<tr>
<td>5000</td>
<td>658</td>
<td>0.45</td>
</tr>
</tbody>
</table>

3. Substitution of fly ash: Maximum of 25 percent by weight of cement at rate of 1 LB fly ash for 1 LB of cement.
4. Sand cement grout:
   a. Three parts sand.
   b. One part Portland cement.
   c. Entrained air: Six percent plus or minus one percent.
   d. Sufficient water for required workability.
   e. Minimum 28-day compressive strength: 3,000 psi.

5. Normal weight concrete:
   a. Proportion mixture to provide desired characteristics using one of methods described below:
      1) Method 1 (Trial Mix):
         a) Per ACI 318, Chapter 5, except as modified herein.
         b) Air content within range specified above.
         c) Record and report temperature of trial mixes.
         d) Proportion trial mixes per ACI 211.1.
      2) Method 2 (Field Experience):
         a) Per ACI 318, Chapter 5, except as modified herein:
         b) Field test records must be acceptable to Engineer to use this method.
         c) Test records shall represent materials, proportions and conditions similar to those specified.
PART 3 - EXECUTION

3.1 FORMING AND PLACING CONCRETE

A. Formwork:
   1. Contractor is responsible for design and erection of formwork.
   2. Construct formwork so that concrete members and structures are of correct size, shape,
      alignment, elevation and position.
      a. Allowable tolerances: As recommended in ACI 347.
   3. Provide slabs and beams of minimum indicated depth when sloping foundation base slabs or
      elevated floor slabs to drains.
      a. For slabs on grade, slope top of subgrade to provide floor slabs of minimum uniform
         indicated depth.
      b. Do not place floor drains through beams.
   4. Openings:
      a. Provide openings in formwork to accommodate work of other trades.
      b. Accurately place and securely support items built into forms.
   5. Chamfer strips: Place 3/4 IN chamfer strips in forms to produce 3/4 IN wide beveled edges
      on permanently exposed corners of members.
   6. Clean and adjust forms prior to concrete placement.
   7. Tighten forms to prevent mortar leakage.
   8. Coat form surfaces with form release agents prior to placing reinforcing bars in forms.

B. Reinforcement:
   1. Position, support and secure reinforcement against displacement.
   2. Locate and support with chairs, runners, bolsters, spacers and hangers, as required.
   3. Set wire ties so ends do not touch forms and are directed into concrete, not toward exposed
      concrete surfaces.
   4. Lap splice lengths: ACI 318 Class B top bar tension splices unless indicated otherwise on
      the Drawings.
   5. Extend reinforcement to within 2 IN of concrete perimeter edges.
      a. If perimeter edge is earth formed, extend reinforcement to within 3 IN of the edge.
   6. Minimum concrete protective covering for reinforcement: As shown on Drawings.
   7. Do not weld reinforcing bars.
   8. Welded wire reinforcement:
      a. Install welded wire reinforcement in maximum practical sizes.
      b. Splice sides and ends with a splice lap length measured between outermost cross wires
         of each fabric sheet not less than:
            1) One spacing of cross wires plus 2 IN.
            2) 1.5 x development length.
            3) 6 IN.
      c. Development length: ACI 318 basic development length for the specified fabric yield
         strength.

C. Construction, Expansion, and Contraction Joints:
   1. Provide at locations indicated.
   2. Locate wall vertical construction joints at 30 FT maximum centers and wall horizontal
      construction joints at 10 FT maximum centers.
   3. Locate construction joints in floor slabs and foundation base slabs so that concrete
      placements are approximately square and do not exceed 2500 SF.
   4. Locate construction joints in columns and walls:
      a. At the underside of beams, and at top of floor slabs.
b. Columns need not be placed monolithically with the floor below.

5. Install construction joints perpendicular to main reinforcement with all reinforcement continued across construction joints.

6. At least 48 HRS shall elapse between placing of adjoining concrete construction.

7. Thoroughly clean and remove all laitance and loose and foreign particles from construction joints.

8. Before new concrete is placed, coat all construction joints with water used and applied in accordance with ACI 318 instructions.

D. Embedments:

1. Set and build in anchorage devices and other embedded items required for other work that is attached to, or supported by concrete.

2. Use setting diagrams, templates and instructions for locating and setting.


E. Placing Concrete:

1. Place concrete in compliance with ACI 304R and ACI 304.2R.

2. Place in a continuous operation within planned joints or sections.

3. Begin placement when work of other trades affecting concrete is completed.

4. Place concrete by methods which prevent aggregate segregation.

5. Do not allow concrete to free fall more than 4 FT.

6. Where free fall of concrete will exceed 4 FT, place concrete by means of tremie pipe or chute.

F. Consolidation: Consolidate all concrete using mechanical vibrators supplemented with hand rodding and tamping, so that concrete is worked around reinforcement and embedded items into all parts of forms.

G. Protection:

1. Protect concrete from physical damage or reduced strength due to weather extremes.

2. In cold weather comply with ACI 306R except as modified herein.

   a. Do not place concrete on frozen ground or in contact with forms or reinforcing bars coated with frost, ice or snow.

   b. Minimum concrete temperature at the time of mixing:

<table>
<thead>
<tr>
<th>OUTDOOR TEMPERATURE AT PLACEMENT (IN SHADE)</th>
<th>CONCRETE TEMPERATURE AT MIXING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 30 DegF</td>
<td>70 DegF</td>
</tr>
<tr>
<td>Between 30-45 DegF</td>
<td>60 DegF</td>
</tr>
<tr>
<td>Above 45 DegF</td>
<td>50 DegF</td>
</tr>
</tbody>
</table>

   c. Do not place heated concrete that is warmer than 80 DegF.

   d. If freezing temperatures are expected during curing, maintain the concrete temperature at or above 50 DegF for 7 days or 70 DegF for 3 days.

   e. Do not allow concrete to cool suddenly.

3. In hot weather comply with ACI 305R except as modified herein.

   a. At air temperature of 90 DegF and above, keep concrete as cool as possible during placement and curing.

   b. Do not allow concrete temperature to exceed 90 DegF at placement.

   c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.

   d. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 LBS/SF/HR as determined from ACI 305R, Figure 2.1.5.

H. Curing:

1. Begin curing concrete as soon as free water has disappeared from exposed surfaces.

2. Cure concrete by use of moisture retaining cover, burlap kept continuously wet or by membrane curing compound.
3. Provide protection as required to prevent damage to concrete and to prevent moisture loss from concrete during curing period.
4. Provide curing for minimum of 7 days.
5. Form materials left in place may be considered as curing materials for surfaces in contact with the form materials except in periods of hot weather.
6. In hot weather follow curing procedures outlined in ACI 305R.
7. In cold weather follow curing procedures outlined in ACI 306R.
8. If forms are removed before 7 days have elapsed, finish curing of formed surfaces by one of above methods for the remainder of the curing period.
9. Curing vertical surfaces with a curing compound:
   a. Cover vertical surfaces with a minimum of two coats of the curing compound.
   b. Allow the preceding coat to completely dry prior to applying the next coat.
   c. Apply the first coat of curing compound immediately after form removal.
   d. Vertical surface at the time of receiving the first coat shall be damp with no free water on the surface.
   e. A vertical surface is defined as any surface steeper than 1 vertical to 4 horizontal.

I. Form Removal:
1. Remove forms after concrete has hardened sufficiently to resist damage from removal operations or lack of support.

3.2 CONCRETE FINISHES

A. See Specification Section 03348.

3.3 GROUT

A. Preparation:
   1. Nonshrink, nonmetallic grout:
      a. Clean concrete surface to receive grout.
      b. Saturate concrete with water for 24 HRS prior to grouting.
   2. Application, nonshrinking, nonmetallic grout:
      a. Mix in a mechanical mixer.
      b. Use no more water than necessary to produce flowable grout.
      c. Place in accordance with manufacturer's instructions.
      d. Completely fill all spaces and cavities below the bottom of baseplates.
      e. Provide forms where baseplates and bedplates do not confine grout.
      f. Where exposed to view, finish grout edges smooth.
      g. Except where a slope is indicated on Drawings, finish edges flush at the baseplate, bedplate, member, or piece of equipment.
      h. Protect against rapid moisture loss by covering with wet rags or polyethylene sheets.
      i. Wet cure grout for seven (7) days, minimum.

3.4 FIELD QUALITY CONTROL

A. Owner will employ and pay for services of a concrete testing laboratory to perform testing of concrete placed during construction.
   1. Contractor to cooperate with Owner in obtaining and testing samples.

B. Tests During Construction:
   1. Strength test - procedure:
      a. Three cylinders, 6 IN DIA x 12 IN high, will be taken from each sample per ASTM C172 and ASTM C31.
      b. Cylinders will be tested per ASTM C39:
         1) One (1) at seven (7) days.
         2) Two (2) at 28 days.
   2. Strength test - frequency:
      a. Not less than one test each day concrete placed.
      b. Not less than one test for each 50 CY or major fraction thereof placed in one day.
3. Slump test:
   a. Per ASTM C143.
   b. Determined for each strength test sample.
   c. Additional slump tests may be taken.
4. Air content:
   b. Determined for each strength test sample.
5. Temperature: Determined for each strength test sample.

C. Evaluation of Tests:
1. Strength test results:
   a. Average of 28-day strength of two cylinders from each sample.
      1) If one cylinder manifests evidence of improper sampling, molding, handling, curing or testing, strength of remaining cylinder will be test result.
      2) If both cylinders show any of above defects, test will be discarded.

D. Acceptance of Concrete:
1. Strength level of each type of concrete shall be considered satisfactory if both of the following requirements are met:
   a. Average of all sets of three consecutive strength tests equals or exceeds the required specified 28-day compressive strength.
   b. No individual strength test falls below the required specified 28-day compressive strength by more than 500 psi.
2. If tests fail to indicate satisfactory strength level, perform additional tests and/or corrective measures as directed by Engineer.
   a. Perform additional tests and/or corrective measures at no additional cost to Owner.

3.5 SCHEDULES

A. Form Types:
1. Surfaces exposed to view:
   a. Prefabricated or job-built wood forms.
   b. Laid out in a regular and uniform pattern with long dimensions vertical and joints aligned.
   c. Produce finished surfaces free from offsets, ridges, waves, and concave or convex areas.
   d. Construct forms sufficiently tight to prevent leakage of mortar.
2. Surfaces normally submerged or not normally exposed to view: Wood or steel forms sufficiently tight to prevent leakage of mortar.
3. Other types of forms may be used:
   a. For surfaces not restricted to plywood or lined forms.
   b. As backing for form lining.

B. Grout:
1. Nonshrinking, nonmetallic grout: General use.
2. Sand cement grout: Keyways of precast members.

C. Concrete:
1. Precast concrete: Where indicated on Drawings.
3. General use concrete: All other locations.

D. Concrete Finishes: See Specification Section 03348.

END OF SECTION
SECTION 03348

CONCRETE FINISHING AND REPAIR OF SURFACE DEFECTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete finishing and repair of surface defects.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 03002 - Concrete.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 116R, Cement and Concrete Terminology.
   2. ASTM International (ASTM):
      d. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
      e. D4259, Standard Practice for Abrading Concrete.
   3. The Society for Protective Coatings/NACE International (SSPC/NACE):
      a. SP 13/NACE No. 6, Surface Preparation of Concrete.

1.3 DEFINITIONS

A. Vertical Surface Defects:
   1. Any void in the face of the concrete deeper than 1/8 IN, such as:
      a. Tie holes.
      b. Air pockets (bug holes).
      c. Honeycombs.
      d. Rock holes.
   2. Scabbing:
      a. Scabbing is defect in which parts of the form face, including release agent, adhere to concrete.
   3. Foreign material embedded in face of concrete.
   4. Fins 1/16 IN or more in height.

B. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

C. Other words and terms used in this Specification Section are defined in ACI 116R.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
3. Certifications:
   a. Certification of aggregate gradation.
   b. Certification that products being used will not interfere with bonding of future floor or
      wall finishes.

B. Informational Submittals:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations and requirements for materials used.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are
   acceptable:
   1. Bonding agents:
      a. Euclid Chemical Co.
      b. BASF Admixtures, Inc.
      c. L&M Construction Chemicals, Inc.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. Bonding Agent:
   1. For use only on concrete surfaces not receiving liquid water repellent coating:
      a. High solids acrylic latex base liquid for interior or exterior application as a bonding
         agent to improve adhesion and mechanical properties of concrete patching mortars.
      b. Euclid Chemical Co. "Flex-Con."
      c. BASF Admixtures, Inc. "Acryl-Set."
      d. L&M Construction Chemicals, Inc. "Everbond."
      e. Thoro System Products "Acryl 60."

B. Cement: ASTM C150, Type I or II.

C. Aggregate:
   1. Sand: Maximum size #30 mesh sieve.

D. Water: Potable.


2.3 MIXES

A. Bonding Grout: One (1) part cement to one (1) part aggregate.

B. Patching Mortar:
   1. One (1) part cement to two and one-half (2-1/2) parts aggregate by damp loose volume.
      a. Substitute white Portland cement for a part of gray Portland cement to produce color
         matching surrounding concrete.
PART 3 - EXECUTION

3.1 PREPARATION

A. Preparation of Bonding Grout Mixture:
1. Mix cement and aggregate.
2. Mix bonding agent and water together in separate container in accordance with manufacturer's instructions.
3. Add bonding agent/water mixture to cement/aggregate mixture.
4. Mix to consistency of thick cream.
5. Bonding agent itself may be used as bonding grout if approved by manufacturer and Engineer.

B. Preparation of Patching Mortar Mixture:
1. Mix cement and aggregate.
2. Mix bonding agent and water together in separate container in accordance with manufacturer's instructions.
3. Add only enough bonding agent/water mixture to cement/aggregate mixture to allow handling and placing.
4. Let stand with frequent manipulation with a trowel, until mix has reached stiffest consistency to allow placement.

C. Clean surfaces in accordance with ASTM D4258 to remove dust, dirt, form oil, grease, or other contaminants prior to abrasive blasting, chipping, grinding or wire brushing.
1. Abrasive blast surfaces in accordance with ASTM D4259 and SSPC SP 13/NACE No. 6 to completely open defects down to sound concrete and remove laitance.
   a. If additional chipping or wire brushing is necessary, make edges perpendicular to surface or slightly undercut.
   b. No featheredges will be permitted.
2. Rinse surface with clean water and allow surface water to evaporate prior to repairing surface defects.

D. Repairing Surface Defects:
1. This method of repairing surface defects is to be used only on vertical concrete surfaces, in tanks containing water, surfaces to receive liquid water repellent and exterior surfaces.
2. Fill and repair using patching mortar mix specified in the MIXES Article in PART 2 of this Specification Section.
   a. Use nonshrink grout to fill tieholes as outlined in this Specification Section.
3. If required by bonding agent manufacturer, etch surfaces with a muriatic acid solution followed by a thorough rinse with clean water.
   a. Test concrete to determine pH level and continue flushing with clean water until surface pH is within acceptable limits.
4. Dampen area to be patched and an area at least 6 IN wide surrounding it prior to application of bonding grout.
5. Brush bonding grout into the surface after the surface water has evaporated.
6. Allow bonding grout to set for period of time required by bonding agent manufacturer before applying premixed patching mortar.
7. Fill tie holes with nonshrink, nonmetallic grout.
   a. Where exposed to view and scheduled to receive concrete Finish #2 or #5, hold grout below surface of concrete and fill with patching mortar to match surrounding concrete.
8. Fill all other defects with patching mortar.
   a. Match color of surrounding wall.
9. Consolidate grout or mortar into place and strike off so as to leave patch slightly higher than surrounding surface.
10. Leave undisturbed for at least 60 minutes before finishing level with surrounding surface.
   a. Do not use metal tools in finishing a patch in a formed wall which will be exposed or coated with other materials.
11. Keep areas damp in accordance with grout manufacturer or bonding agent manufacturer's directions.

3.2 INSTALLATION AND APPLICATION

A. Do not repair surface defects or apply wall or floor finishes when temperature is or is expected to be below 50 DegF.
   1. If necessary, enclose and heat area to between 50 and 70 DegF during repair of surface defects and curing of patching material.
      a. Use only clean fuel, indirect fired heating apparatus.

B. Concrete Finishes for Vertical Wall Surfaces:
   2. Finish #1 - As cast rough form finish:
      a. Selected forming materials are not required.
      b. Prepare surface in accordance with the PREPARATION Article in PART 3 of this Specification Section and repair the following surface defects:
         1) Tie holes.
         2) Honeycombs deeper than 1/4 IN.
         3) Air pockets deeper than 1/4 IN.
         4) Rock holes deeper than 1/4 IN.
      c. Chip or rub off fins exceeding 1/4 IN in height.
      d. Use at unexposed surfaces such as foundations and backfilled surfaces of walls not to be waterproofed.
   3. Finish #5 - Smooth form finish:
      a. Form facing material shall produce a smooth, hard, uniform texture.
      1) Use forms specified for surfaces exposed to view in accordance with Specification Section 03002.
      b. Prepare surface in accordance with the PREPARATION Article in PART 3 of this Specification Section and repair the following surface defects:
         1) Tie holes.
         2) Honeycombs, air pockets, rock holes and other holes deeper than 1/16 IN or larger than 1/16 IN DIA.
      c. Chip or rub off fins exceeding 1/16 IN in height.
      d. Provide this finish for:
         1) All surfaces which are to be painted or are to remain exposed to view.

C. Related Unformed Surfaces (Except Slabs):
   1. Strike smooth and level tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces after concrete is placed.
   2. Float surface to a texture consistent with that of formed surfaces.
      a. If more than one (1) finish occurs immediately adjacent to unformed surface, provide surface with most stringent formed surface requirement.
   3. Continue treatment uniformly across unformed surfaces.

D. Concrete Finishes for Horizontal Slab Surfaces:
   1. General:
      a. Tamp concrete to force coarse aggregate down from surface.
      b. Screed with straightedge, eliminate high and low places, bring surface to required finish elevations; slope uniformly to drains.
      c. Dusting of surface with dry cement or sand during finishing processes not permitted.
   2. Unspecified slab finish:
      a. When type of finish is not indicated, use following finishes as applicable:
         1) Surfaces intended to receive roofing: Floated finish.
         2) Floors: Troweled finish.
3. Exterior slabs, sidewalks, platforms, steps and landings, and ramps, not covered by
other finish materials: Broom or belt finish.
4) All slabs to receive a floated finish before final finishing.

3. Floated finish:
   a. After concrete has been placed, consolidated, struck off, and leveled, do no further
      work until ready for floating.
   b. Begin floating when water sheen has disappeared and surface has stiffened sufficiently
      to permit operations.
      1) Use wood or cork float.
   c. During or after first floating, check planeness of entire surface with a 10 FT
      straightedge applied at not less than two (2) different angles.
   d. Cut down all high spots and fill all low spots to produce a surface with Class B
      tolerance throughout.
   e. Refloat slab immediately to a uniform texture.

4. Troweled finish:
   a. Float finish surface to true, even plane.
   b. Power trowel, and finally hand trowel.
   c. First troweling after power troweling shall produce a smooth surface which is relatively
      free of defects, but which may still show some trowel marks.
   d. Perform additional trowelings by hand after surface has hardened sufficiently.
   e. Final trowel when a ringing sound is produced as trowel is moved over surface.
   f. Thoroughly consolidate surface by hand troweling.
   g. Leave finished surface essentially free of trowel marks, uniform in texture and
      appearance and plane to a Class A tolerance.
   h. On surfaces intended to support floor coverings, remove any defects that would show
      through floor covering by grinding.

5. Broom or belt finish: Immediately after concrete has received a float finish as specified, give it a transverse scored texture by drawing a broom or burlap belt across surface.

6. Underside of concrete slab finish:
   a. Match finish as specified for adjacent vertical surfaces.
   b. If more than one (1) finish occurs immediately adjacent to underside of slab surface,
      provide surface with most stringent formed surface requirement.

3.3 FIELD QUALITY CONTROL

A. Horizontal slab finishes will be accepted provided:
   1. Applicable specification requirements are satisfied.
   2. Water does not pond in areas sloped to drain.
   3. Gap between a 10 FT straightedge placed anywhere and the finished surface does not
      exceed:
      a. Class A tolerance: 1/8 IN.
      b. Class B tolerance: 1/4 IN.
      c. Class C tolerance: 1/2 IN.
   4. Accumulated deviation from intended true plane of finished surface does not exceed 1/2 IN.
   5. Accuracy of floor finish does not adversely affect installation and operation of movable
      equipment, floor supported items, or items fitted to floor (doors, tracks, etc.).

B. Unacceptable finishes shall be replaced or, if approved in writing by Engineer, may be corrected
   provided strength and appearance are not adversely affected.
   1. High spots to be removed by grinding and/or low spots filled with a patching compound or
      other remedial measures to match adjacent surfaces.
3.4 PROTECTION

A. All horizontal slab surfaces receiving chemical floor sealer shall be kept free of traffic and loads for minimum of 72 HRS following installation of sealer.

END OF SECTION
SECTION 03431

PRECAST AND PRESTRESSED CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Precast and prestressed concrete.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 03002 - Concrete.
   4. Section 09905 - Painting and Protective Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. HB, Standard Specifications for Highway Bridges.
   2. American Concrete Institute (ACI):
      a. 211.2, Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
      b. 318, Building Code Requirements for Structural Concrete.
   3. ASTM International (ASTM):
      c. A416, Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
      d. A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
      e. A1064, Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
      b. A5.5/A5.5M, Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding.
      c. D1.1, Structural Welding Code - Steel.
      d. D1.4, Structural Welding Code - Reinforcing Steel.
   5. Occupational Safety and Health Administration (OSHA).
   6. Precast/Prestressed Concrete Institute (PCI):
      a. MNL 116, Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.
      b. MNL 120, Design Handbook - Precast and Prestressed Concrete.
   7. Building Code:
      a. International Code Council (ICC):
B. Qualifications:
   1. Provide precast and prestressed concrete units produced by an active member of PCI.
   2. Provide units manufactured by plant which has regularly and continuously engaged in
      manufacture of units of same type as those required for a minimum of three (3) years.
   3. Assure manufacturer's testing facilities meet requirements of ASTM E329.
   4. Welding operators and processes to be qualified in accordance with:
      a. AWS D1.1 for welding steel shapes and plates.
      b. AWS D1.4 for welding reinforcing bars.
   5. Welding operators to have passed qualification tests for type of welding required during the
      previous 12 months prior to commencement of welding.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Sizes, types and manufacturer of bearing pads.
      d. Hardware to be utilized to support suspended appurtenances.
   3. Shop Drawings and erection plans for precast units, their connections and supports showing:
      a. Member size and location.
      b. Size, configuration, location and quantity of reinforcing bars and prestressing strands.
      c. Initial prestress forces.
      d. Size and location of openings verified by Contractor.
      e. Size, number, and locations of embedded metal items and connections.
      f. Required concrete strengths.
      g. Identification of each unit using same standard marking numbers as used to mark actual
         units.
   4. Calculations for members and connections designed by fabricator.
      a. Calculations to be sealed by a professional Structural Engineer registered in the State of
         South Dakota.
      b. Perform calculations using the dead load of the members plus the superimposed
         uniform and concentrated loads shown on the Drawings and indicated in this
         Specification Section.
      c. Indicate the following:
         1) Design for maximum moment, maximum shear and maximum torsion.
         2) Final top and bottom flexural stresses resulting from the stresses due to maximum
            moment and prestress force.
         3) Ultimate moment capacity.
         4) Final top and bottom flexural stresses, ultimate moment capacity, and ultimate
            shear capacity, if affected, for members with reduced cross sections due to
            openings or penetrations.
   5. Embedded connection items:
      a. Connection items to have an ultimate load capacity of at least two (2) times the required
         indicated load.
   6. Concrete mix design(s) including submittal information defined in Specification Section
      03002.
   7. Copies of source quality control tests.
   8. Certification of manufacturer's testing facility qualifications.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Headed studs and deformed bar anchors:
      b. KSM Division, Omark Industries.
   2. Bearing pads:
      a. JVI, Inc.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. Embedded Steel Plates and Shapes: ASTM A36.
   1. Galvanized: ASTM A123/A123M, minimum 2.0 OZ zinc per square foot of metal surface.

B. Bearing Pads:
   1. Random, fiber-reinforced elastomeric pads.
   2. Preformed, randomly oriented synthetic fibers set in elastomer.
   3. Shore-A hardness: 70 to 90 per ASTM D2240.
   4. Capable of supporting a compressive stress of 3000 psi with no cracking, splitting or delaminating in the internal portions of the pad.
   5. Masticord as manufactured by JVI, Inc.

C. Cement: Comply with ASTM C150, Type I or III.

D. Aggregates for Normal Weight Concrete:
   1. ASTM C33 with coarse aggregate meeting the gradation for Size 67 as stated in ASTM C33.
   2. Provide aggregates approved for bridge construction by the State Highway Department in the State of South Dakota.
   3. All fine aggregate to be natural not manufactured.

E. Water:
   1. Potable, clean.

F. Maximum total chloride ion content contributed from all ingredients of concrete including water, aggregates, cement and admixtures measured as a weight percent of cement to not exceed 0.06.

G. Prestressing Strands:
   1. Either 250K or 270K high tensile strength uncoated seven (7) wire strand.
   2. Manufacture and test strands in accordance with ASTM A416.


I. Headed Studs:
   1. ASTM A108.
   2. Minimum yield strength: 50,000 psi.
   3. Minimum tensile strength: 60,000 psi.

J. Deformed Bar Anchors:
   1. ASTM A496 or ASTM A1064.
   2. Minimum tensile strength: 80,000 psi.
   3. Minimum yield strength: 70,000 psi.

K. Electrodes:
   1. E70 series conforming to AWS A5.1/A5.1M or AWS A5.5/A5.5M for welding steel shapes and plates.
   2. E90 series conforming to AWS A5.5/A5.5M for welding rebar.
L. Concrete sand cement grout in keyways between hollow core slabs.
   1. See Specification Section 03002.

**2.3 DESIGN**

A. General Design Requirements:
   1. Design units and connections in strict accordance with ACI 318 and the PCI MNL 120.
   2. Design units for spans, dead load of members, dead and live loads indicated on the
      Drawings with concentrated loads placed in their actual locations.
      a. Verify weights and locations of concentrated loads.
   3. Design units taking into account reduced cross section at openings and penetrations.
   4. Provide all reinforcing in units as indicated.
      a. Where not indicated, design and provide all reinforcing and prestressing strands subject
         to approval of Engineer.
   5. Due to presence of corrosive atmosphere, design prestressed members for no tension in
      bottom of members resulting from loads indicated on Drawings and in this Specification
      Section.

**2.4 MIXES**

A. See Specification Section 03002.

B. Do not begin fabrication of units until concrete mix design(s) have been approved by Engineer.

**2.5 FABRICATION**

A. Do not fabricate units until Shop Drawings have been approved by Engineer and returned to
   Contractor and support locations have been field verified by Contractor.

B. Manufacture, quality, dimensional and erection tolerances of all units to be in accordance with
   both PCI MNL 116 and PCI MNL 120.

C. Cast all members in smooth rigid forms which will provide straight, true members of uniform
   thickness and uniform color and finish.

D. Use sand cement grout mixture to fill all air pockets and voids, and to repair chipped edges.

E. Finish all repairs smooth and to match adjacent surface texture and color.

F. Where units are to receive concrete topping, provide units having heavy broom finish on top
   surface for bond.
   1. Provide roughness of top surface to provide bond with topping and design for horizontal
      shear at topping and unit interface in accordance with requirements of ACI 318, Horizontal
      Shear Strength paragraph.
   2. Make all other surfaces smooth.

G. Incorporate embedded plates, angles, and flange welding strips into members at time of
   manufacture.
   1. Provide embedded items as shown on the Drawings unless prior approval is received from
      Engineer to do otherwise.
   2. Cast lifting handles into units at or near support points.
      a. Remove lifting handles after units are erected.

H. Cast openings larger than 4 IN SQ or 4 IN DIA in units at time of manufacture.
   1. Make smaller openings by neat cutting or neat drilling by trades requiring them.
   2. Coordinate sizes and locations of all openings before fabrication of units.

I. Make provisions for support of lighting fixtures, ducts, piping, conduits and other suspended
   work.
   1. When drilled expansion bolts or powder-driven fasteners are approved for use, coordinate
      prestress strand location with prestress concrete member supplier so that drilled expansion
      bolts or powder-driven fasteners do not hit or are drilled or driven into prestress strands.
2. Install powder-driven fasteners by means of a low velocity powder-actuated tool complying with requirements of OSHA.
   a. Assure that the load to be supported by each in place drilled expansion bolt or powder-driven fastener does not exceed the maximum allowable load recommended by the bolt or fastener manufacturer for the concrete strength encountered and for the type, size and embedment length of expansion bolt or driven fastener installed.

J. Automatically weld headed studs and deformed bar anchors to members to provide full penetration weld between studs, bar anchors and members they are attached to.

K. Weld steel shapes and plates per AWS D1.1 and reinforcing steel per AWS D1.4.

L. Minimum concrete compressive strength at time of strand release: 3500 psi.

M. Mark each unit as indicated on the erection plans.
   1. Place mark on non-exposed-to-view surface.

N. Coat or finish ends of exposed prestressing strands to prevent rusting.

O. Fabricate the following types of precast and prestressed units (all units to be made with normal weight concrete unless noted otherwise on Drawings):
   1. Prestressed hollow core slabs of sizes indicated.
      a. Weight of hollow core slabs not to exceed the following:

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>NORMAL WEIGHT CONCRETE</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 IN</td>
<td>70 psf</td>
</tr>
</tbody>
</table>

2. Precast items shown on Drawings including but not limited to:
   a. Hollow core slabs.

2.6 SOURCE QUALITY CONTROL

A. During production of precast concrete units, conduct strength tests of concrete placed in units as required in Specification Section 03002 for concrete placed during fabrication.
   1. Results of strength tests to be sent immediately to Engineer, Contractor and Owner.
   2. Test reports to indicate units they represent.

B. When approved by Engineer, strength tests may be made by precast manufacturer after he has submitted certification that his testing facilities meet the requirements of ASTM E329.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify acceptability and location of supports to receive units.
   1. Check bearing surfaces to determine that they are level and uniform.

B. Verify compressive strengths of concrete and masonry supports.
   1. Do not start erection of units until supports have reached their 28 day required compressive strengths.

3.2 ERECTION

A. Sequence erection to provide a balance of loads.

B. Give consideration to possible lack of stability or capacity of partially completed frame or structure.

C. Contractor to be responsible for guying, shoring, and bracing of frame, walls and individual members as necessary to resist forces due to wind, erection, or any other source that may occur before structure is completed.
D. Use only erection equipment adequate for placing units at lines and elevations indicated on Drawings.
   1. Do not damage units or existing construction during erection.
   2. Erect units using lifting handles cast into the units.
E. Place hollow core slabs on continuous 1/4 IN thick bearing pad so that width equals bearing length -1/2 IN.
F. After erection, verify that there is no direct contact between bottom of units and supporting members.
   1. Where direct contact occurs, install additional layers of bearing material to raise units off supports.
G. Weld steel shapes and plates per AWS D1.1 and reinforcing steel per AWS D1.4.
H. Fill all keyways between hollow core slabs with concrete sand cement grout.
   1. See Specification Section 03002.
I. After all precast units are erected and all precast unit connections have been made, coat all exposed surfaces of the connections with the same prime and finish paint as required on the adjacent precast concrete units.
   1. See Specification Section 09905.

3.3 FIELD QUALITY CONTROL
A. Causes for rejection of units include, but are not necessarily limited to the following:
   1. Cracked units.
   2. Chipped, broken, or spalled edges.
   3. Units not within allowable casting tolerances.
   4. Voids or air pockets which, in opinion of Engineer, are too numerous or too large.
   5. Non-uniform finish or appearance.
   7. Improperly placed embedded items and/or openings.
   8. Exposed wire mesh, reinforcing or prestressing strands.

END OF SECTION
DIVISION 04
MASONRY
SECTION 04050
COLD AND HOT WEATHER MASONRY CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cold weather protection.
   2. Hot weather protection.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute/American Society of Civil Engineers/The Masonry Society
      (ACI/ASCE/TMS):
   2. International Masonry Industry All-Weather Council (IMIAWC):
   3. National Concrete Masonry Association (NCMA):
      a. TEK 3-1C, All Weather Concrete Masonry Construction.

1.3 DEFINITIONS

A. Hot Weather Construction: Per ACI 530.1/ASCE 6/TMS 602, hot weather construction is
   defined as occurring when ambient temperatures exceed 100 DegF or 90 DegF when the wind
   velocity is greater than 8 mph.

B. Cold Weather Construction: Per ACI 530.1/ASCE 6/TMS 602, cold weather construction is
   defined as occurring when ambient temperature falls below 40 DegF or when the temperature of
   the masonry units is below 40 DegF.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

3.1 ERECTION AND APPLICATION

A. General:
   1. Comply with NCMA TEK 3-1C recommendations and practices.
   2. Do not use frozen or ice coated materials.
   3. At end of each day or at shutdown, cover tops of all walls not enclosed or sheltered with clear
      polyethylene minimum 6 mil thick.
      a. Extend down each side of wall minimum of 16 IN and secure.

B. Temporary Facilities:
   1. Construct and maintain temporary protection required to permit continuous and orderly
      progress of work.
2. Provide and maintain heat sufficient to assure temperature above 32 DegF within protected areas.
3. Remove all temporary facilities after completion of work.

C. Cold Weather Construction and Protection Requirements:

1. Prior to and during installation:
   a. Air temperature 32 to 40 DegF: Heat mixing water or aggregate to produce mortar temperatures between 40 and 120 DegF.
   b. Air temperature 25 to 32 DegF:
      1) Heat mixing water or aggregate to produce mortar temperatures between 40 and 120 DegF.
      2) Maintain mortar temperatures above freezing until used.
   c. Air temperature below 25 DegF:
      1) Heat mixing water and aggregate to produce mortar temperatures between 40 and 120 DegF.
      2) Maintain mortar temperatures above freezing until used.
      3) Maintain temperature of units until laid at not less than 40 DegF.
      4) Provide heat on both sides of walls under construction to maintain air temperature above freezing.
      5) Provide windbreaks or shelters when wind is in excess of 15 mph.
   a) Wind breaks or shelters shall be translucent.

2. After installation:
   a. Air temperature 32 to 40 DegF: Protect from rain or snow for not less than 24 HRS by covering with weather-resistant translucent membrane.
   b. Air temperature 25 to 32 DegF: Completely cover with translucent weather-resistant membrane for not less than 24 HRS.
   c. Air temperature 20 to 25 DegF: Completely protect with insulating blankets for not less than 24 HRS or provide other protection approved by Engineer.
   d. Air temperature below 20 DegF:
      1) Provide enclosed translucent shelters and heating to maintain air temperature on each side of wall above 32 DegF for 24 HRS.
      2) Do not allow rapid drop in temperature after removal of heat.
   e. Promptly repair all tears, holes, etc., to translucent membrane and shelter using compatible patching material and tape as recommended by membrane manufacturer.

D. Hot Weather Construction and Protection Requirements:

1. Comply with requirements of IMIAWC, NCMA and ACI/ASCE/TMS.

2. Storage and preparation of materials.
   a. Cover or shade masonry units and mortar materials from direct sun.
   b. Maintain sand in a damp loose condition.
      1) Sand moisture shall be maintained at minimum 8 percent.
      2) Sprinkle with cool water as required to maintain moisture content.
   c. Use cool water for mixing mortars.
   d. Avoid using tools and equipment that have been sitting in the sun.
      1) Sprinkle mortar boards, mortar pans, wheel barrows, mixers, etc., with cool water.
   e. Do not wet concrete masonry units prior to use.

3. Installation:
   a. Place masonry units within one minute of the spreading of the mortar.
      1) Mortar beds shall not be spread more than 4 FT ahead of the masonry unit being placed.
   b. Provide wind screens and shading partitions as required to eliminate direct sunlight exposure.
   c. Wet installed units using fog spray of clean water.
   d. Cover installed work immediately after installation to slow rate of loss of moisture from units.
e. Fog-spray new masonry work until damp.
   1) Repeat fog spraying minimum of three (3) times per day until masonry work has
cured for 72 HRS.
   2) In high humidity conditions, Engineer reserves the right to discontinue fog
spraying if operation is found to be introducing excessive amounts of moisture into
the Work.

END OF SECTION
SECTION 04110
MASONRY MORTAR AND GROUT

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Masonry mortar.
   2. Masonry grout.
   3. Integral water repellent admixture.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 04220 - Concrete Masonry.

1.2 QUALITY ASSURANCE
A. Referenced Standards:
   1. American Concrete Institute/American Society of Civil Engineers/The Masonry Society
      (ACI/ASCE/TMS):
   2. ASTM International (ASTM):
      i. C1093, Standard Practice for Accreditation of Testing Agencies for Masonry.
   3. Building code:
      a. International Code Council (ICC):
            amendments, referred to herein as Building Code.
   B. Qualifications:
      1. Testing Laboratory shall be an independent agency qualified in accordance with
         ASTM C1093 for performing the testing indicated.
      a. Testing Laboratory shall have a minimum of 10 years experience in the testing of
         mortar and grout.
      2. Technician conducting tests shall have minimum of five (5) years experience in the testing
         of mortar and grout.

1.3 DEFINITIONS
A. Coarse grout and fine grout are defined by the aggregate size used in accordance with
   ASTM C476.
B. Coarse aggregate and fine aggregate are defined in ASTM C404, Table 1.
1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Proposed mortar mix design, including proposed preblended, prepackaged dry mortar
         mixes.
         1) Proposed mortar mix for fire rated construction.
         2) Proposed mortar mix design to include brand, type and manufacturer of all
            cementitious materials and source or producer of aggregate.
         3) Provide integral water repellent manufacturer's certified recommended dosage rate
            for mortar batched each day during masonry construction.
      c. Proposed masonry grout mix designs
         1) Submit designs for both fine and coarse grout.
   3. Test results:
      a. Preconstruction mortar test results.
      b. Preconstruction masonry grout test results.
      c. Strength test results for all mortar and masonry grout (both coarse and fine grout)
         placed during construction.
      d. Slump test results of all masonry grout placed during construction.

B. Samples:
   1. Actual colored mortar samples for color selection by Engineer.
      a. Color card and plastic simulations are not acceptable.

C. Informational Submittals:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Qualifications of testing lab and technician.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store cementitious materials on elevated platforms, under cover, and in a dry location.
   1. Do not use cementitious materials that have become damp.

B. Store aggregates where grading and other required characteristics can be maintained and
   contamination avoided.

C. Deliver preblended, dry mortar mix in moisture-resistant containers.
   1. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover,
      and in a dry location or in a metal dispensing silo with weatherproof cover.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement:
   1. ASTM C150, Type I or II.
   2. No air entrainment.
   3. Natural color.
   4. Maximum percent of alkalis: 0.60 in accordance with ASTM C150, Table 1A.

B. Hydrated Lime:
   1. ASTM C207, Type S.
   2. Type SA not acceptable.
   3. Lime substitutes are not acceptable.
C. Mortar Aggregate: ASTM C144, free of gypsum.

D. Masonry Grout:
   1. ASTM C476.
   2. No admixtures allowed.

E. Grout Aggregate: ASTM C404.

F. Water: Potable.

G. Mortar Pigments:
   1. Commercial colorants suitably compounded for use in mortar mixes.
   2. Do not exceed manufacturer's recommended pigment-to-cement ratios.

H. Integral Water Repellent Admixture:
   1. Liquid polymeric admixture: ASTM C1384.
   2. Verify compatibility with liquid water repellent admixture being used in the fabrication of concrete masonry units.
   3. Do not use integral water repellent admixture in mortar for brick.

2.2 MIXES

A. Type "S" mortar shall be used:
   1. Comply with ASTM C270, Table No. 1.
   2. Do not use masonry cement.
   3. Mix materials minimum of three (3) minutes and maximum of five (5) minutes.
   4. Adjust consistency to satisfaction of mason.
   5. Do not use admixtures unless otherwise indicated.
   6. Provide integral water repellent admixture in all mortar used for exterior veneer masonry work.

B. Masonry Grout:
   2. Use no anti-freeze additives.
   3. No fly ash additives will be accepted.
   4. Mix 5 minutes minimum.
   5. Slump: 8 to 11 IN.
   6. Do not add integral water repellent admixture to masonry grout mix.
   7. At Contractor's option, manufactured grout meeting the above minimum requirements may be used.
   8. Minimum 28-day compressive strength: 2,000 psi.

2.3 SOURCE QUALITY CONTROL

A. Perform preconstruction laboratory tests on proposed masonry grout mix prior to start of masonry work.
   1. Perform tests far enough in advance so that any necessary retesting can be accomplished before masonry construction begins.
      a. Test grout per ASTM C1019.

B. Source Limitations for Mortar Materials:
   1. Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one (1) source or producer for each aggregate.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions and ACI 530.1/ASCE 6/TMS 602.
B. Use coarse grout in spaces with least dimension over 2 IN.
C. Consolidate all grout while installing.
   1. Consolidate grout pours 12 IN or less in height by mechanical vibration or by puddling.
   2. Consolidate grout pours exceeding 12 IN in height by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.
D. Use colored mortar for exterior veneer masonry.

3.2 FIELD QUALITY CONTROL

A. Mortar:
   1. If standard gray mortar begins to stiffen, it may be retempered by adding water and remixing unless prohibited by water repellent admixture manufacturer.
      a. Standard gray mortar shall not be retempered more than one (1) time.
      b. Colored mortar shall not be retempered.
   2. All mortar must be used within 2-1/2 HRS maximum after initial mixing per ACI 530.1/ASCE 6/TMS 602.
B. Engineer reserves right to alter mix design based on initial rate of absorption of masonry units.
C. Masonry Grout:
   1. Use grout within 1-1/2 HRS maximum after initial mixing.
   2. Use no grout after it has begun to set.
   3. Do not retemper grout after initial mixing.
   4. Place grout in lifts not exceeding 4 FT.
D. Masonry Grout Testing:
   1. Testing and inspection services will be provided by the Owner's special masonry inspector.
      a. Do not include in the bid price the cost of these services.
   2. Conduct compressive strength tests and slump tests on all masonry grout used during masonry construction.
   3. Perform all compressive strength test sampling, testing and reporting per ASTM C1019.
   4. Perform all slump test sampling, testing, and reporting per ASTM C143.
   5. Frequency of sampling: One (1) sample (three (3) specimens) collected each grouting operation during masonry construction.
   6. Compressive strength testing:
      a. One (1) strength test shall be the average of three (3) specimens from the same sample, tested at 28 days.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Masonry accessories.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 04220 - Concrete Masonry.
   4. Section 05505 - Metal Fabrications.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
      d. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   2. Building Code:
      a. International Code Council (ICC):

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Tear resistance of flashing material.
      d. Manufacturer's recommendations for flashing adhesive.
      e. Manufacturer's data sheet on each product.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Weep vents for cavity wall construction:
   a. Heckman Building Products Inc.
   b. Hohmann & Barnard, Inc.
   c. Wire Bond.
   d. Mortar Net USA, Ltd.

2. Masonry anchors, horizontal joint reinforcing veneer anchors and miscellaneous anchors:
   a. Heckman.
   b. Hohmann & Barnard, Inc.
   c. Wire Bond.

3. Thru wall flashing:
   a. EPDM:
      1) Carlisle Syntech Systems, Inc.
      2) Firestone Building Products Co.

4. Weep joint mortar protection system:
   a. Mortar Net USA, Ltd.
   b. Hohmann & Barnard, Inc.
   c. Wire Bond.

5. Preformed control joint inserts:
   a. Hohmann & Barnard, Inc.
   b. Wire Bond.

6. Grout screen:
   a. Wire Bond.
   b. Heckman Building Products.
   c. Hohmann & Barnard, Inc.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MANUFACTURED UNITS

A. Thru Wall Flashing and Stainless Steel Drip:
   1. 40 mil EPDM manufactured specifically for thru wall flashing.
      a. Tear resistance: ASTM D624, 150 LB/IN minimum.
      b. Width as required.
      1) Provide single piece full width, no horizontal joints will be allowed unless approved in writing by Engineer.
      c. Factory precut wherever possible.
      d. Factory fabricated inside and outside corners when available.

2. Stainless steel drip:
   a. ASTM A666, Type 316.
   c. Minimum 26 GA.
   d. Maximum lengths of 10 FT.
      1) Extend horizontally the full depth of veneer.
   e. Factory fabricated.
   f. Factory fabricated inside and outside corners with a minimum return of 16 IN on each leg.
      1) Weld all joints and grind smooth.
   g. Provide 1/2 IN drip leg on exterior side of wall.
   h. Refer to the Drawings for profile.
   i. Lap sealant: VULKEM 922.
B. Flashing Adhesive: As recommended by flashing manufacturer for sealing laps, sealing to vertical masonry and concrete surfaces and sealing to stainless steel surfaces.

C. Weep Vent:
   1. 90 percent open mesh vent designed to be placed in vertical mortar joint.

D. Horizontal Joint Reinforcing:
   1. General:
      a. Conform to ASTM A951.
      b. Cold drawn stainless steel wire, ASTM A580, Type 304 or 316.
      c. 9 GA side rods.
      d. 9 GA cross rods.
      e. Prefabricated corner and tee sections with minimum length of 30 IN from point of intersection.
   2. Cavity wall joint reinforcing with masonry back-up:
      a. Ladder design horizontal joint reinforcing.
      b. Wire eyes welded to horizontal joint reinforcing.
         1) Length as required to project through rigid insulation into airspace.
      c. 3/16 IN DIA adjustable pintle veneer anchors.
         1) Length as required to provide minimum 2 IN embed into veneer mortar joint.
      d. Hohmann & Barnard "270 Ladder."

E. Grout Screen:
   1. Polypropylene monofilament.
   2. 1/4 x 1/4 IN mesh.
   3. Width of grout screen to be 2 IN less than nominal width of CMU.

F. Weep Joint Mortar Protection System:
   1. 100 percent recycled polyester.
   2. 90 percent minimum open weave mesh.
   3. Minimum 10 IN high by full width of air cavity.

G. Preformed Rubber Control Joint Inserts:
   5. Hohmann & Barnard #RS Series.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide stainless steel accessories unless specifically noted otherwise.

C. Thru Wall Flashing and Stainless Steel Drip:
   1. Install to provide positive drainage of cavity moisture.
   2. Extend flashing horizontally beyond each edge of lintel or sills to next vertical mortar joint but not less than 4 IN and turn up edge one (1) full veneer course.
      a. Seal all joints.
   3. Where thru wall flashing and stainless steel drip steps up or down in the wall, provide end dam at step.
      a. End dam shall extend up or down to tie into thru wall flashing step.
      b. Seal all joints for continuous watertight barrier.
   4. At concrete masonry unit back-up, install upper edge of flashing into block joint.
5. Adhere vertical surface of flashing to back-up wall with adhesive recommended by flashing manufacturer.
6. Extend flashing minimum of 6 IN above top of weep joint mortar protection system.
7. Lap and seal flashing at all inside and outside corners to provide continuous uninterrupted barrier.

D. Weeps:
1. Provide open weep joints at maximum 16 IN OC in head joint of first course of veneer immediately above thru wall flashing.
   a. Omit mortar bed on top of thru wall flashing at each open weep joint location to allow moisture an unobstructed path to the exterior.
   b. Weep joints shall be not more than 4 IN high.
2. Provide weep vents maximum 16 IN OC in top of head joint of top course of veneer or as indicated on Drawings.
   a. Do not use weep vents in weep joints at the bottom of the wall.
   b. Set weep vents back away from face of veneer slightly so the front edge of the vent is contained within the mortar joint.

E. Weep Joint Mortar Protection System:
1. Install continuous row(s) of material.
2. Provide multiple thicknesses of material compressed as necessary to completely fill the entire air cavity.
   a. Thickness to be at least 10 percent wider than air cavity being filled.
3. Set material directly on top of thru wall flashing.

F. Butt joints of preformed control joint inserts tightly together and secure with adhesive or sealant acceptable to insert manufacturer.

G. Anchoring Veneer:
1. Veneer with concrete block back-up:
   a. Anchor veneer to new construction using horizontal joint reinforcing and adjustable pintle veneer anchors.

H. Reinforcing Masonry:
1. General:
   a. Provide continuous horizontal joint reinforcing in all concrete masonry wall construction.
      1) Embed longitudinal side rods in mortar for entire length with minimum cover of 5/8 IN on exterior side of walls and 1/2 IN at other locations.
         a) For interior partitions, the "exterior" side of the wall is considered the side having the most corrosive atmosphere or the corridor side of the wall.
      2) Lap reinforcement minimum of 12 IN at ends.
         a) Remove cross wires on one (1) side of the lap splice and bend the side rods slightly so the lap is provided with 12 IN of uninterrupted wire lap occurring in the same plane.
   b. Do not bridge control joints with horizontal joint reinforcing.
   c. Do not bridge expansion joints with horizontal joint reinforcing.
   d. At corners and wall intersections use prefabricated "L" and "T" horizontal joint reinforcing sections.
   e. Cut and bend as required.
   f. Install reinforcing at 16 IN OC vertically unless noted otherwise on Drawings.
   g. Install reinforcing 8 IN OC vertically for a minimum of 24 IN at starter courses.
      1) Do not install horizontal joint reinforcing in veneer mortar joint having through-wall flashing.
   h. Install horizontal joint reinforcing and adjustable pintle veneer anchors at 8 IN OC in parapets.
      1) Parapets begin at the course immediately above the top of the roof structural member or top of concrete topping slab on precast roof structure.
e. Install additional horizontal joint reinforcing and adjustable pintle veneer anchors 16 IN OC in courses on each side of vertical control joints and on each jamb of openings for full height of joint or opening.
   1) Alternate with normal wall horizontal joint reinforcing.
   2) Extend reinforcing minimum 32 IN beyond joint or jambs of opening.

f. Reinforce masonry openings over 12 IN wide with horizontal joint reinforcing and adjustable pintle veneer anchors placed in three (3) horizontal joints above lintel and two (2) horizontal joints below sill.
   1) Extend minimum of 32 IN beyond jambs of opening.

2. Reinforcing concrete masonry:
   a. Install reinforcing bars where indicated on Drawings.
      1) Provide means necessary to ensure position of vertical steel reinforcing meets requirements of Building Code.

3. Reinforcing veneer:
   a. Reinforce veneer with joint reinforcement placed in veneer mortar joints:
      1) Alternate veneer horizontal joint reinforcing with horizontal joint reinforcing and adjustable pintle veneer anchors.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete masonry construction (CMU) including all standard concrete masonry, and pre-colored units.
   2. Integral water repellent admixture.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 03002 - Concrete.
   4. Section 04050 - Cold and Hot Weather Masonry Construction.
   5. Section 04110 - Cement and Lime Mortars.
   7. Section 07210 - Building Insulation.
   8. Section 07900 - Joint Sealants.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI)/American Society of Civil Engineers (ASCE)/The Masonry Society (TMS):
   2. ASTM International (ASTM):
      b. C90, Standard Specification for Loadbearing Concrete Masonry Units.
   3. National Concrete Masonry Association (NCMA):
      a. TEK 2-3A, Architectural Concrete Masonry Units.
      b. TEK 3-4B, Bracing Concrete Masonry Walls During Construction.
      c. TEK 8-2A, Removal of Stains from Concrete Masonry.
      d. TEK 8-3A, Control and Removal of Efflorescence.
   4. Building Code:
      a. International Code Council (ICC):
   5. Concrete masonry unit manufacturer shall be licensed or qualified, in writing, by manufacturer of integral water repellent admixture to produce masonry units containing manufacturer's admixture.
   6. Concrete masonry unit manufacturer shall have a minimum of five (5) years experience producing masonry units containing manufacturer's admixture.

B. All masonry units of any one (1) particular type, color or face style shall be from the same production run.
   1. Special shapes shall be factory fabricated unless noted otherwise.

1.3 DEFINITIONS

A. Exterior Environment: For purposes of manufacturing concrete masonry units using integral water repellent admixture, all concrete masonry units are considered to be installed in an exterior environment.
1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Manufacturer's information on aggregate and cement type used in manufacture.
      b. Scaled (minimum 1/8 IN per foot) Drawings showing proposed locations of masonry control joints.
      c. Data sheets on integral water repellent admixture being used in masonry unit manufacturing.
      d. Technical bulletins on cleaning masonry containing integral water repellant.

B. Certifications:
   a. Certification that concrete masonry units meet or exceed requirements of standards referenced.
   b. Certification that integral water repellent admixture will not affect the use of coloring processes or alter the actual colors of factory colored masonry units.
   c. Certification of integral water repellent admixture dosage rates from concrete masonry unit producer.
   d. Concrete masonry producer shall certify that integral liquid water repellent admixture has been provided at dosage rate recommended by admixture manufacturer for use in exterior wall construction.
   e. Certification that concrete masonry units meet all requirements for strength, absorption, density, moisture content and dimensions when tested according to ASTM C140.
      1) Submit test results prior to shipping masonry units to the job site.

B. Samples:
   1. Sample of pre-colored concrete masonry units proposed to match existing construction.
      a. Provide actual masonry samples.
         1) Minimum two (2) 2 x 8 x 8 IN samples.
         2) Samples shall show color range and texture range to be expected in the Project.
         3) Color cards are not acceptable.

C. Informational Submittals:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver units on pallets with tight covers or deliver in cubes and store on dunnage.

B. Protect units from damage.

C. Inspect units upon delivery for damage, to assure color match with mock-up or approved samples, dimensional quality, and trueness of unit.
   1. Remove damaged or otherwise unacceptable units from the Project Site.

D. Store units in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Integral water repellent admixture:
      a. Grace Construction Products.
2.2 MATERIALS

A. Concrete Masonry Units:
   1. Modular units, ASTM C90.
      a. Provide aggregate in accordance with ASTM C33.
   b. Total linear drying shrinkage: ASTM C90.
   c. Weight: Minimum of 125 LB/CF.
   d. Medium weight or light weight units are not acceptable.
   2. Face shell and web thickness: ASTM C90, Table 1.
   3. Water absorption: ASTM C90 Table 2.
   4. Concrete bricks of same material, texture and quality.
   5. Compressive strength: ASTM C90, Table 2.
   7. Manufacture all standard masonry units using integral water repellent admixture.

B. Reinforcing Bars: Refer to Specification Section 03002 and as indicated on Drawings.

C. Mortar: Refer to Specification Section 04110.

D. Masonry Grout: Refer to Specification Section 04110.

E. Masonry Accessories: Refer to Specification Section 04155.

F. Sealants: Refer to Specification Section 07900.

G. Polystyrene Masonry Core Insert Insulation: Refer to Specification Section 07210.

H. Foamed Plastic Insulation: Refer to Specification Section 07210.

I. Integral Concrete Masonry Water Repellent:
   1. Liquid polymeric admixture.
   2. Water permeance of masonry: Capable of achieving a Class E Rating when evaluated using
      ASTM E514 with the test extended to 72 HRS, using the rating criteria specified in
      ASTM E514.

2.3 FABRICATION

A. Concrete Masonry Units:
   1. Color:
      a. Interior units: Standard gray.
      b. Exposed exterior units: Match existing.
   2. Design compressive strength: f'm=1,500 psi minimum.
      a. Determine in accordance with unit strength method per ACI 530.1/ASCE 6/TMS 602.
   3. Fabricated in the manufacturing plant.
   4. Provide square corners.
   5. Special shapes and faces:
      a. Split face.
      b. Scored face with joints at 8 IN OC.
      c. Field cutting scored joints is not allowed.
      d. Other special shapes as noted on Drawings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that anchors and flashings are correct.

B. Lay out walls in advance for uniform and accurate spacing of bond patterns and joints.
   1. Properly locate openings, movement type joints, returns, and offsets.
3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. General:

1. Build cavity walls to thickness indicated on Drawings.
2. Build in flashing, reinforcing, weeps, weep vents and related accessory items.
   a. See Specification Section 04155 for installation of accessory items.
3. Perform all cutting with masonry saws using saw blades as recommended by masonry unit manufacturer.
4. Drill holes with power drill using drill bits as recommended by masonry unit manufacturer.
5. Holes made by chipping unit will not be accepted.
6. Install field units in running bond.
   a. Provide special coursing where indicated on the Drawings.
7. Cut as required to maintain bond pattern.
8. Use solid units where cutting or laying would expose holes and as noted on Drawings.
9. Avoid use of less than half size units, whenever possible.
10. Do not use chipped, cracked, spalled, stained or imperfect units exposed in finish work.
11. Do not wet concrete masonry units.
12. At all electrical light fixture locations, outlet boxes, other electrical device boxes and equipment, wall hydrants, hose bibbs, fire department sprinkler connections or any other device, box, etc., which must be sealed to the face of the exterior masonry, provide smooth face concrete block, of the same color as surrounding block, at the device or box location.
   a. Verify the area of smooth face required and center the device or box in the area unless noted otherwise on the Drawings.
   b. Verify location of all smooth face masonry units prior to installation.

C. Laying and Tooling:

1. Lay masonry units with completely filled bed and head joints.
   a. Provide full mortar bed on all block cross webs and completely fill head joints.
      1) Do not slush head joints.
      2) Protect cells requiring grout fill from mortar droppings.
      3) Omit mortar from head joint at weep joint opening.
   b. Taper mortar on inside edge of veneer and outside edge of masonry back-up to prevent mortar from falling into cavity.
   c. Protect cavity during laying of masonry as required to prevent mortar droppings from clogging cavity.
   d. Install weep joint mortar protection system in cavity per Specification Section 04155.
   a. Cut joints flush where concealed.
   b. Tool exposed joints concave.
   c. Compress mortar in below ground joints and in joints concealed by insulation in cavity wall construction.
   d. Provide wider joints where noted on Drawings.
      1) In no case shall any mortar joint be more than 3/4 IN wide.
   e. Where masonry sits on top of steel support omit the mortar joint on top of the support and sit masonry directly on top of the thru wall flashing or the steel support member unless a mortar joint is required to maintain coursing.
3. During tooling of joints, enlarge any voids or holes except weeps, and completely fill with mortar.
4. Point-up all joints at corners, openings, and adjacent work to provide neat, uniform appearance.
5. Remove masonry disturbed after laying.
   a. Clean and relay in fresh mortar.
   b. Do not pound units to fit.
   c. If adjustments are required, remove units, clean, and reset in fresh mortar.
6. Where work is stopped and later resumed, rake back 1/2 masonry unit length in each course.
   a. Remove loose units and mortar prior to laying fresh masonry.

7. As work progresses, build in items indicated on Drawings and specified.
   a. Fill in solidly with mortar around built-in items.
   b. Where built-in items are to be embedded in cores of hollow masonry units, place grout
      screen in joint below and fill core solid with mortar.

D. Control Joints and Sealants:
   1. Provide vertical expansion, control and isolation joints where indicated on Drawings.
   2. Where not indicated on Drawings, submit proposed control joint locations in accordance
      with the following requirements:
      a. Provide control joints at maximum 24 FT OC.
      b. Provide at all T intersections.
      c. Locate joints so as to allow lintels and bond beams above and below openings to extend
         beyond the opening as indicated on the Drawings without control joints thru the lintel
         or bond beam.
   3. Rake out mortar in joint.
      a. Exercise care not to damage thru wall flashing.
   4. Seal control and expansion joints.
      a. Refer to Specification Section 07900.

E. Tolerances:
   1. Maximum variation from plumb in vertical lines and surfaces of columns, walls, and arises:
      a. 1/4 IN in 10 FT.
      b. 3/8 IN in a story height not to exceed 20 FT.
      c. 1/2 IN in 40 FT or more.
   2. Maximum variation from plumb for external corners, expansion joints, and other
      conspicuous lines:
      a. 1/4 IN in any story or 20 FT maximum.
      b. 1/2 IN in 40 FT or more.
   3. Maximum variation from level of grades for exposed lintels, sills, parapets, horizontal
      grooves, and other conspicuous lines:
      a. 1/4 IN in any bay or 20 FT.
      b. 1/2 IN in 40 FT or more.
   4. Maximum variation from plan location of related portions of columns, walls, and partitions:
      a. 1/2 IN in any bay or 20 FT.
      b. 3/4 IN in 40 FT or more.
   5. Maximum variation in cross-sectional dimensions of columns and thicknesses of walls from
      dimensions shown on Drawings:
      a. Minus 1/4 IN.
      b. Plus 1/2 IN.
   6. Maximum variation in mortar joint width:
      a. Bed joints: 3/32 IN in 10 FT.
      b. Head joints:
         1) Minus 1/8 IN.
         2) Plus 1/8 IN.

F. Protect against weather.
   1. During inclement weather conditions, cover top of walls with translucent waterproof
      membrane.
   2. See Specification Section 04050.

G. Protect against cold/hot weather as specified in Specification Section 04050.

3.3 FIELD QUALITY CONTROL

A. Bracing Concrete Masonry Walls During Construction:
   1. At a minimum, provide bracing in accordance with NCMA TEK 3-4B.
2. Contractor is responsible for adequately bracing all masonry during construction.

B. Remove and replace loose, stained, damaged and other unacceptable units as directed by Engineer.
   1. Provide new units to match.
   2. Install in fresh mortar.
   3. Point to eliminate evidence of replacement.

C. Special Masonry Inspection:
   1. Masonry inspection services will be provided during the following construction activities:
      a. Cost of masonry inspection services will be paid by Owner.
      b. During laying of units:
         1) During the first day of the masonry construction, inspect proportions of site prepared mortar, construction of mortar joints, location of all reinforcing and connectors, size and location of structural elements, type, size and location of anchors, protection of masonry during cold weather.
         2) Inspection to be continuous the first full day of masonry construction which requires special inspection.
            a) Thereafter, a minimum of 3 HRS every third day of construction until the concrete masonry work is complete.
         3) Inspection while laying masonry units may be made concurrently with other inspection duties provided all inspection duties are adequately performed.
         4) When deficiencies are found, additional inspection shall be provided as required until deficiencies have been corrected.
         5) If masonry crews change, an additional full day of inspection is required during the first day the new crew is on-site.
      c. Placement of reinforcing steel:
         1) Verification of all reinforcing including size, grade, lap lengths, and type.
         2) Inspection may be periodic as required to verify all reinforcing.
         3) Inspector to be present during the concrete pour in which any dowels connecting concrete to masonry are cast to verify proper location of dowels.
      d. Prior to each grouting operation, verify that grout space is clean, reinforcing is clean and connectors are properly placed, proportions of site-prepared grout are correct and mortar joints have been properly constructed.
         1) Inspection may be periodic as required to verify proper grout space.
      e. Verify compliance with Building Code and Specifications continuously during all grouting operations.
      f. Provide special inspection in accordance with the Building Code 1704.5.2 including observation of masonry work for conformance to the Contract Documents:
         1) Provide inspection reports to the Engineer, Building Official and Owner.
            a) Notify Contractor of discrepancies for correction.
            b) Notify Engineer, Building Official and Owner, in writing, when discrepancies have been satisfactorily corrected.
         2) Submit final signed report stating that work requiring special inspection was, to the best of the inspector's knowledge, in conformance to the Contract Documents and the applicable workmanship provisions of the Building Code.

3.4 CLEANING

A. Clean concrete masonry as the wall is being constructed using fiber brushes, wooden paddles and scrapers.
   1. No acid-based cleaning solutions shall be used unless approved in writing by Engineer.
2. Remove primary efflorescence from masonry walls constructed with water repellent admixture, in accordance with the unit manufacturer's recommendations and NCMA TEK 8-3A.

3. Remove dirt and stains from masonry in accordance with manufacturer's recommendations and NCMA TEK 8-2A.

END OF SECTION
SECTION 05505
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Custom fabricated metal items and certain manufactured units not otherwise indicated to be
      supplied under work of other Specification Sections.
   2. Design of all temporary bracing not indicated on Drawings.
   3. Design of systems and components, including but not limited to:
      a. Modular framing system.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 03002 - Concrete.
   4. Section 06610 - Fiberglass Reinforced Plastic Fabrication.
   5. Section 09905 - Painting and Protective Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Institute of Steel Construction (AISC):
      b. 360, Specifications for Structural Steel Buildings (referred to herein as AISC
         Specification).
   2. ASTM International (ASTM):
      a. A6, Standard Specification for General Requirements for Rolled Structural Steel Bars,
         Plates, Shapes, and Sheet Piling.
      e. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated,
         Welded and Seamless.
      g. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron
         and Steel Products.
      h. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel
         Hardware.
      j. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel
         Tubing for General Service.
      l. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile
         Strength.
      m. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked
         Austenitic Stainless Steel Pipes.
      n. A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi
         Minimum Tensile Strength.
      o. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel
         Parts, Equipment, and Systems.
q. A500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

r. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.


v. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

w. A668, Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.


z. A1064, Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.


3. American Welding Society (AWS):


b. D1.1, Structural Welding Code - Steel.

c. D1.6/D1.6M, Structural Welding Code - Stainless Steel.


5. Nickel Development Institute (NiDI):

a. Publication 11 007, Guidelines for the welded fabrication of nickel-containing stainless steels for corrosion resistant services.

6. Occupational Safety and Health Administration (OSHA):

a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.

7. Building Code:

a. International Code Council (ICC):


B. Qualifications:

1. Qualify welding procedures and welding operators in accordance with AWS.

2. Fabricator shall have minimum of 10 years experience in fabrication of metal items specified.

3. Engineer for contractor-designed systems and components: Professional structural engineer licensed in the State of South Dakota.

1.3 DEFINITIONS

A. Fasteners: As defined in ASTM F1789.

B. Galvanizing: Hot-dip galvanizing per ASTM A123/A123M or ASTM A153/A153M with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

C. Hardware: As defined in ASTM A153/A153M.

D. Installer or Applicator:

   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
1. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01340 for requirements for the mechanics and administration of
the submittal process.
2. Fabrication and/or layout Drawings and details:
   a. Submit Drawings for all fabrications and assemblies.
      1) Include erection Drawings, plans, sections, details and connection details.
   b. Identify materials of construction, shop coatings and third party accessories.
3. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Provide manufacturer's standard allowable load tables for the following:
      1) Expansion anchor bolts.
      2) Adhesive anchor bolts.
4. Contractor designed systems and components:
   a. Certification that manufactured units meet all design loads specified.
   b. Shop Drawings:
      1) Sealed by A Professional Structural Engineer.
      2) Engineer will review for general compliance with Contract Documents.

B. Informational Submittals:
1. See Specification Section 01340 for requirements for the mechanics and administration of
the submittal process.
2. Certification of welders and welding processes.
   a. Indicate compliance with AWS.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and handle fabrications to avoid damage.
B. Store above ground on skids or other supports to keep items free of dirt and other foreign debris
and to protect against corrosion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are
acceptable:
1. Headed studs and deformed bar anchors:
   b. Stud Welding Products, Inc.
2. Expansion anchor bolts:
   a. Hilti Inc.
   b. ITW Ramset/Red Head.
   c. Simpson Strong-Tie.
3. Epoxy adhesive anchor bolts:
   a. Hilti Inc.
   b. ITW Ramset/Red Head.
   c. Simpson Strong-Tie.
4. Self-tapping concrete anchors:
   a. ITW Buildex.
   b. Powers Fasteners.
5. Galvanizing repair paint:
   a. Clearco Products Co., Inc.
   b. ZRC Products.
2.2 MATERIALS

A. Steel:
   1. Structural:
      a. W-shapes and WT-shapes: ASTM A992, Grade 50.
      b. All other plates and rolled sections: ASTM A36.
   2. Pipe: ASTM A53, Types E or S, Grade B or ASTM A501.
   3. Structural tubing:
      a. ASTM A500, Grade B (46 ksi minimum yield).
   4. Bolts, nuts and washers, high strength:
      a. ASTM A325.
      b. Provide two (2) washers with all bolts.
   5. Bolts and nuts:
      a. ASTM A307, Grade A.
   7. Steel forgings: ASTM A668.

B. Iron:
   1. Ductile iron: ASTM A536.
   2. Gray cast iron: ASTM A48 (minimum 30,000 psi tensile strength).

C. Stainless Steel:
   1. Stainless steel in welded applications: Low carbon 'L' type.
   2. Minimum yield strength of 30,000 psi and minimum tensile strength of 75,000 psi.
      a. Bars, shapes: ASTM A276, Type 316.
      b. Tubing and pipe: ASTM A269, ASTM A312 or ASTM A554, Type 316.
      c. Strip, plate and flat bars: ASTM A666, Type 316.
      d. Bolts and nuts: ASTM F593, Type 316.
   3. Minimum yield strength of 25,000 psi and minimum tensile strength of 70,000 psi.
      a. Strip, plate and flat bar for welded connections, ASTM A666, Type 316L.
   4. Welding electrodes: In accordance with AWS for metal alloy being welded.

D. Washers: Same material and alloy as found in accompanying bolts and nuts.

E. Embedded Anchor Bolts:
   1. All anchor bolts: Type 304 or 316 stainless steel with matching nut and washer.

F. Expansion Anchor Bolts and Adhesive Anchor Bolts:
   1. Stainless steel, Type 316.
   2. Provide minimum edge distance cover and spacing as recommended by manufacturer, or as indicated on Drawings whichever is larger.
      a. Minimum embedment as recommended by manufacturer or eight (8) diameters of bolt, whichever is larger.
      b. Notify Engineer if required depth of embedment cannot be achieved at a particular anchor bolt location.
      c. Follow manufacturer's recommendations for installation and torque.
   3. Submit manufacturer's load test data to verify at least the anchor bolt capacities at the following embedment depths:
      a. Data must be based on actual tests performed in unreinforced mass of concrete of not more than 4000 psi compressive strength.
      b. Capacity must be at a concrete temperature of at least 130 DegF.

<table>
<thead>
<tr>
<th>ANCHOR BOLT DIAMETER (IN)</th>
<th>EMBEDMENT (IN)</th>
<th>MINIMUM ULTIMATE TENSION CAPACITY (KIP)*, **</th>
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<tbody>
<tr>
<td>3/8</td>
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<td>4.8</td>
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### ANCHOR BOLT DIAMETER (IN) | EMBEDMENT (IN) | MINIMUM ULTIMATE TENSION CAPACITY (KIP)*, **
---|---|---
5/8 | 5 | 11.4
3/4 | 6 | 15.4
7/8 | 7 | 20.0
1 | 8 | 24.7
1-1/4 | 10 | 34.3

* Data must be based on actual tests performed in unreinforced mass concrete of not more than 4000 psi compressive strength.
** Capacity must be at a concrete temperature of at least 130 DegF.

4. Expansion anchor bolts:
   a. Kwik Bolt by Hilti, Inc.
   b. Trubolt by ITW Ramset/Red Head.
   c. Wedge-All by Simpson Strong-Tie.

5. Adhesive anchor bolts:
   a. HVA Adhesive Anchor System by Hilti.
   b. HIT HY 150 Adhesive Anchor by Hilti.
   c. HSE 2411 Epoxy Adhesive Anchor by Hilti.
   d. EPCON Ceramic 6 Epoxy by ITW Ramset/Red Head.
   e. Acrylic-Tie by Simpson Strong-Tie.

6. Self-tapping concrete anchors:
   a. Tapcon by ITW Buildex.
   b. 410 stainless steel.
   c. 1/4 IN DIA with 5/16 IN hex head.

   1) Minimum embedment as recommended by manufacturer.

G. Headed Studs: ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile strength of 60,000 psi.

H. Deformed Bar Anchors: ASTM A496 or ASTM A1064 with a minimum yield strength of 70,000 psi and a minimum tensile strength of 80,000 psi.

I. Iron and Steel Hardware: Galvanized in accordance with ASTM A153/A153M when required to be galvanized.

J. Galvanizing Repair Paint:
   1. High zinc dust content paint for regalvanizing welds and abrasions.
   2. ASTM A780.
   3. Zinc content: Minimum 92 percent in dry film.
   4. ZRC "ZRC Cold Galvanizing" or Clearco "High Performance Zinc Spray."


### 2.3 MANUFACTURED UNITS

A. Loose Lintels:
   1. Steel, ASTM A36 or ASTM A572 Grade 50, sizes as indicated on Drawings.
   2. Hot-dip galvanized per ASTM A123/A123M.

B. Modular Framing System:
   1. Materials:
      b. Fiberglass: See Specification Section 06610.
   2. Channels and inserts:
      a. Steel or stainless steel: Minimum 12 GA.
      b. Channels to have one (1) side with a continuous slot with in-turned lips.
         1) Width: 1-5/8 IN.
         2) Depth and configuration as necessary for loading conditions.
3. Fittings: Same material as system major components.

4. Fasteners:
   a. Nuts: Toothed grooves in top of nuts to engage the in-turned lips of channel.
   b. Bolts: Hex-head cap screws.
   c. Same material as system major components.

5. End caps:
   a. At each exposed end of each piece mounted on walls, or guardrails, or suspended from framing 7 FT or less above the floor or platform.
      a) Plastic for all exposed ends 7 FT or more above floor or platform.
      b) Plastic or metallic for all other exposed ends.

6. Schedule:
   a. Interior corrosive areas: Fiberglass.
   b. Exterior areas: Stainless steel.

7. Provide dissimilar materials protection in accordance with Specification Section 09905.

2.4 FABRICATION

A. Verify field conditions and dimensions prior to fabrication.

B. Form materials to shapes indicated with straight lines, true angles, and smooth curves.
   1. Grind smooth all rough welds and sharp edges.
      a. Round all corners to approximately 1/32 - 1/16 IN nominal radius.

C. Provide drilled or punched holes with smooth edges.
   1. Punch or drill for field connections and for attachment of work by other trades.

D. Weld Permanent Shop Connections:
   1. Welds to be continuous fillet type unless indicated otherwise.
   2. Weld structural steel in accordance with AWS D1.1 using Series E70 electrodes conforming to AWS A5.1/A5.1M.
   3. Weld stainless steel in accordance with AWS D1.6.
      a. Treat all welded areas in accordance with ASTM A380.
   4. Weld stainless steel in accordance with AWS D1.6 and NiDI 11 007.
   5. All headed studs to be welded using automatically timed stud welding equipment.
   6. Grind smooth welds that will be exposed.

E. Conceal fastenings where practicable.

F. Fabricate work in shop in as large assemblies as is practicable.

G. Tolerances:
   1. Rolling:
      a. ASTM A6.
      b. When material received from the mill does not satisfy ASTM A6 tolerances for camber, profile, flatness, or sweep, the Contractor is permitted to perform corrective work by the use of controlled heating and mechanical straightening, subject to the limitations of the AISC Specification.

2. Fabrication tolerance:
   a. Member length:
      1) Both ends finished for contact bearing: 1/32 IN.
      2) Framed members:
         a) 30 FT or less: 1/16 IN.
         b) Over 30 FT: 1/8 IN.
   b. Member straightness:
      1) Compression members: 1/1000 of axial length between points laterally supported.
      2) Non-compression members: ASTM A6 tolerance for wide flange shapes.
   c. Specified member camber (except compression members):
      1) 50 FT or less: Minus 0/plus 1/2 IN.
      2) Over 50 FT: Minus 0/plus 1/2 IN (plus 1/8 IN per 10 FT over 50 FT).
3) Members received from mill with 75 percent of specified camber require no further cambering.
4) Beams/trusses without specified camber shall be fabricated so after erection, camber is upward.
5) Camber shall be measured in fabrication shop in unstressed condition.
6) At bolted splices, depth deviation shall be taken up by filler plates.
7) At welded joints, adjust weld profile to conform to variation in depth.
8) Slope weld surface per AWS requirements.
9) Finished members shall be free from twists, bends and open joints.
10) Sharp kinks, bends and deviation from above tolerances are cause for rejection of material.

H. Fabricate miscellaneous metals in accordance with NAAMM AMP 555.
   1. Workmanship: Class 2 unless noted otherwise.

I. See Specification Section 09905 for preparation and painting of ferrous metals and other surfaces.

J. Passivate stainless steel items and stainless steel welds after they have been ground smooth, where indicated on Drawings.
   1. ASTM A380.

2.5 SOURCE QUALITY CONTROL

A. Surface Preparation:
   1. Refer to Specification Section 09905 for surface preparation requirements.
   2. All miscellaneous metal fabrication item surfaces shall be inspected and approved by NACE certified coatings inspector prior to application of shop-applied paint coating.
      a. Inspection shall be performed to determine depth of blast profile and cleanliness of surface.
      b. Fabricator shall reblast and or re-clean surfaces as required until acceptable.

B. Shop Applied Paint Coating Application:
   1. Refer to Specification Section 09905 for painting requirements.
   2. After surface has been accepted in writing by NACE certified coatings inspector, fabricator may proceed with application of paint coatings.
   3. Application of paint coatings shall be observed and certified by NACE certified coatings inspector.

C. Owner Pays for Field Inspection and Testing:
   1. Owner will employ and pay for services of an independent testing agency to inspect and test structural steel shop and field work for compliance with this Specification Section.
   2. Contractor responsible for testing to qualify shop and field welders and as needed for Contractor's own quality control to ensure compliance with Contract Documents.
   3. Contractor provides sufficient notification and access so inspection and testing can be accomplished.
   4. Contractor pays for retesting of failed tests and for additional testing required when defects are discovered.

D. Contractor Pays for Shop Inspection and Testing:
   1. Employ and pay for the services of a qualified independent testing agency to inspect and test all structural steel work for compliance with Contract Documents.
   2. Independent testing agency shall have a minimum of five (5) years performing similar work and shall be subject to Owner's approval.

E. Responsibilities of Testing Agency:
   1. Inspect shop and field welding in accordance with AWS Code including the following non-destructive testing:
      a. Visually inspect all welds.
b. In addition to visual inspection, test 50 percent of full penetration welds and 20 percent of fillet welds with liquid dye penetrant.
c. Test 20 percent of liquid dye penetrant tested full penetration welds with ultrasonic or radiographic testing.

2. Inspect high-strength bolting in accordance with the RCSC Specification for Structural Joints Using High-Strength Bolts, Section 9.
   a. Verify direct tension indicator gaps.
3. Inspect structural steel which has been erected.
4. Inspect stud welding in accordance with AWS Code.
5. Prepare and submit inspection and test reports to Engineer.
   a. Assist Engineer to determine corrective measures necessary for defective work.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide items to be built into other construction in time to allow their installation.
   1. If such items are not provided in time for installation, cut in and install.
B. Prior to installation, inspect and verify condition of substrate.
C. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.

3.2 INSTALLATION

A. Set metal work level, true to line, plumb.
   1. Shim and grout as necessary.
B. Contractor is solely responsible for safety.
   1. Construction means and methods and sequencing of work is the prerogative of the Contractor.
   2. Take into consideration that full structural capacity of many structural members is not realized until structural assembly is complete; e.g., until slabs, decks, and diagonal bracing or rigid connections are installed.
   3. Partially complete structural members shall not be loaded without an investigation by the Contractor.
   4. Until all elements of the permanent structure and lateral bracing system are complete, temporary bracing for the partially complete structure will be required.
C. Adequate temporary bracing to provide safety, stability and to resist all loads to which the partially complete structure may be subjected, including construction activities and operation of equipment is the responsibility of the Contractor.
   1. Plumb, align, and set structural steel members to specified tolerances.
   2. Use temporary guys, braces, shoring, connections, etc., necessary to maintain the structural framing plumb and in proper alignment until permanent connections are made, the succeeding work is in place, and temporary work is no longer necessary.
   3. Use temporary guys, bracing, shoring, and other work to prevent injury or damage to adjacent work or construction from stresses due to erection procedures and operation of erection equipment, construction loads, and wind.
   4. Contractor shall be responsible for the design of the temporary bracing system and must consider the sequence and schedule of placement of such elements and effects of loads imposed on the structural steel members by partially or completely installed work, including work of all other trades.
   a. If not obvious from experience or from the Drawings, the Contractor shall confer with the Engineer to identify those structural steel elements that must be complete before the temporary bracing system is removed.
   5. Remove and dispose of all temporary work and facilities off-site.
D. Examine work-in-place on which specified work is in any way dependent to ensure that conditions are satisfactory for the installation of the work.
   1. Report defects in work-in-place which may influence satisfactory completion of the work.
   2. Absence of such notification will be construed as acceptance of work-in-place.

E. Field Measurement:
   1. Take field measurements as necessary to verify or supplement dimensions indicated on the Drawings.
   2. Contractor responsible for the accurate fit of the work.

F. Check the elevations of all finished footings or foundations and the location and alignment of all anchor bolts before starting erection.
   1. Use surveyor's level.
   2. Notify Engineer of any errors or deviations found by such checking.

G. Framing member location tolerances after erection shall not exceed the frame tolerances listed in the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.

H. Erect plumb and level; introduce temporary bracing required to support erection loads.

I. Use light drifting necessary to draw holes together.
   1. Drifting to match unfair holes is not allowed.

J. Welding:
   1. Conform to AWS D1.1 and requirements of the FABRICATION Article in PART 2 of this Specification Section.
   2. When joining two (2) sections of steel of different ASTM designations, welding techniques shall be in accordance with a qualified AWS D1.1 procedure.

K. Shore existing members when unbolting of common connections is required.
   1. Use new bolts for rebolting connections.

L. Clean stored material of all foreign matter accumulated during erection period.

M. Bolt Field Connections: Where practicable, conceal fastenings.

N. Field Welding:
   1. Follow AWS procedures.
   2. Grind welds smooth where field welding is required.

O. Remove all burrs and radius all sharp edges and corners of miscellaneous plates, angles, framing system elements, etc.

P. Unless noted or specified otherwise:
   1. Connect steel members to steel members with 3/4 IN DIA ASTM A325 high strength bolts.
   2. Provide washers for all bolted connections.
   3. Where exposed, bolts shall extend a maximum of 3/4 IN and a minimum of 1/2 IN above the top nut.
      a. If bolts are cut off to required maximum height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nuts.

Q. Install and tighten ASTM A325 high-strength bolts in accordance with the AISC 325, Allowable Stress Design (ASD).
   1. Provide hardened washers for all ASTM A325 bolts.
      a. Provide the hardened washer under the element (nut or bolt head) turned in tightening.

R. After bolts are tightened, upset threads of ASTM A307 unfinished bolts or anchor bolts to prevent nuts from backing off.

S. Secure metal to wood with lag screws of adequate size with appropriate washers.
T. Do not field splice fabricated items unless said items exceed standard shipping length or change of direction requires splicing.
   1. Provide full penetration welded splices where continuity is required.

U. Provide each fabricated item complete with attachment devices as indicated or required to install.

V. Anchor such that work will not be distorted nor fasteners overstressed from expansion and contraction.

W. Set beam and column base plates accurately on nonshrink grout as indicated on Drawings.
   1. See Division 03 Specification Sections for non-shrink grout.
   2. Set and anchor each base plate to proper line and elevation.
      a. Use metal wedges, shims, or setting nuts for leveling and plumbing columns and beams.
         1) Wedges, shims and setting nuts to be of same metal as base plate they support.
         2) Tighten nuts on anchor bolts.
      b. Fill space between bearing surface and bottom of base plate with nonshrink grout.
         1) Fill space until voids are completely filled and base plates are fully bedded on wedges, shims, and grout.
      c. Do not remove wedges or shims.
         1) Where they protrude, cut off flush with edge of base plate.
      d. Fill sleeves around anchor bolts solid with non-shrink grout.

X. Tie anchor bolts in position to embedded reinforcing steel using wire.
   1. Tack welding prohibited.
      a. Coat bolt threads and nuts with heavy coat of clean grease.
   2. Anchor bolt location tolerance:
      a. 1/16 IN.
      b. Provide steel templates for all column anchor bolts.

Y. Provide abrasive stair nosings in each tread and landing of all concrete stairs and at each concrete stair landing having metal stair structure attaching to the concrete landing.
   1. Center stair nosings in stair width.
   2. Coordinate nosings with railing vertical posts.
      a. Maintain 2 IN clear between end of nosing and edge of railing base plate.

Z. Accurately locate and place frames for openings before casting into floor slab so top of plate is flush with surface of finished floor.
   1. Keep screw holes clean and ready to receive screws.

AA. Repair damaged galvanized surfaces in accordance with ASTM A780.
   1. Prepare damaged surfaces by abrasive blasting or power sanding.
   2. Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's instructions.

BB. Install factory pre-fabricated stairs in location indicated in the Contract Documents.

3.3 FIELD QUALITY CONTROL

A. Tolerances (unless otherwise noted on the Drawings):
   1. Frame placement, after assembly and before welding or tightening.
      a. Deviation from plumb, level and alignment: 1 in 500, maximum.
      b. Displacement of centerlines of columns: 1/2 IN maximum, each side of centerline location shown on Drawings.

3.4 CLEANING

A. After fabrication, erection, installation or application, clean all miscellaneous metal fabrication surfaces of all dirt, weld slag and other foreign matter.
B. All stainless steel products in addition to Paragraph A. above:

1. Remove all heat tint, rusting, discoloration by passivation, ASTM A380, or other acceptable means as listed in NiDI 11 007 as approved by the Engineer.

C. Provide surface acceptable to receive field applied paint coatings specified in Specification Section 09905.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Rough carpentry.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 05505 - Metal Fabrications.
   4. Section 07534 - Adhered Elastomeric (EPDM) Sheet Roofing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. APA - The Engineered Wood Association (APA):
      a. U450E, Storage and Handling of APA Trademarked Panels.
   2. ASTM International (ASTM):
   3. American Wood Protection Association (AWPA):
   4. Environmental Protection Agency (EPA).
   5. National Institute of Standards and Technology (NIST):
      a. PS-1, Construction and Industrial Plywood.
      b. PS-20, American Softwood Lumber Standard.
   6. Underwriters Laboratories, Inc. (UL):
   7. Building Code:
      a. International Code Council (ICC):
   B. Qualifications:
      2. Treated Wood Inspection: AWPA M2.
   C. Miscellaneous:
      1. Factory marking:
         a. Lumber:
            1) Identify type, grade, moisture content, inspection service, producing mill, and other qualities specified.
            2) Marking may be omitted, as allowed by Building Code, if certificate of inspection is provided for each shipment.
1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Fabrication Drawings of all fabricated items.
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions for all products specified.
   4. Certifications:
      a. Chemicals used in treatment process are registered with and approved by EPA.
      b. Moisture content of material prior to treatment: 25 percent maximum.
      c. Material has been kiln-dried after treatment (KDAT) to the moisture content specified.
      d. Documentation of treatment of fire retardant treated material in accordance with
         standards referenced.

1.4 DELIVERY AND STORAGE

A. Delivery, storage and handling of untreated wood products:
   1. Lumber: As recommended by the grading agency indicated on the grade stamp.
   2. Plywood: APA U450E.

B. Delivery, storage, handling and disposal of treated wood products: AWPA M4.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable
   Articles below are acceptable.
B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. General:
   1. Lumber (for framing, blocking, nailers, furring, grounds and similar members):
      a. NIST PS-20.
      b. Species:
         1) Treated material: As indicated in the appropriate AWPA standard and as required
            to achieve UL rating listed herein.
         c. Grade:
            1) For nominal sizes up to and including 2 x 4: Standard and better.
            2) For nominal sizes up to 2 IN thick and wider than 4 IN: #2 and better.
   2. Non-structural plywood:
      a. NIST PS-1.
      b. C-C plugged:
         1) Exposure: EXT.
         2) Thickness: 3/4 IN.
         3) Touch sanded.
      3. Moisture content:
         b. Lumber, 19 percent maximum.
         c. Plywood, 15 percent maximum.
   B. Fire-Retardant Treated Material (FRTM):
      1. Acceptable manufacturer:
      a. Hoover Treated Wood Products, Inc.: "Exterior Fire-X".
      2. Maximum moisture content:
         a. Prior to treatment: 25 percent.
b. Kiln-dry after treatment (KDAT), ASTM D4442 and ASTM D4444:
   1) Lumber: 19 percent (KDAT).
   2) Plywood: 15 percent (KD-15).

3. Fire-retardant preservative:
   a. Provide protection against decay:
      1) EPA registered for use as a wood preservative.
   b. Shall not bleed-through or adversely affect bond of any finish.

4. Pressure-treat material in accordance with AWPA U1 and the following:

5. UL Classified:
   a. FR-S, UL 723.
   b. Exterior: No increase in classification when subjected to the Standard Rain Test, ASTM D2898.
   c. Provide UL mark on each piece of FRTM.


7. Wherever practicable, material to be treated shall be manufactured in its final form prior to treatment.

C. Fasteners and Anchors:
   1. Proper type, size, material, and finish for application.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify measurements, dimensions, and shop drawing details before proceeding.

B. Coordinate location of studs, nailers, blocking, grounds and similar supports for attached work.

C. Eliminate sharp projections which would puncture roofing, flashing or underlayment material.

3.2 ERECTION AND INSTALLATION

A. General:
   1. Provide treated material in accordance with appropriate AWPA standard for intended end use.
   2. Provide fire-retardant treated material for all wood used:
      a. In roof construction.
      b. For roofing nailers.

B. Attach work securely by anchoring and fastening as indicated or required to support applied loading.
   1. Provide washers under bolt heads and nuts.
   2. Fasten plywood in accordance with APA recommendations.
   3. Use galvanized nails and fasteners unless indicated otherwise.
      a. When anchoring treated wood material use appropriately treated fasteners for corrosion protection against the chemicals used in the wood treatment process.
   4. Use common wire nails or screws for general work.
   5. Use fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials.
   6. Install fasteners without splitting of wood; predrill as required.
   7. Do not drive threaded friction type fasteners.
   8. Tighten bolts and lag screws at installation and retighten as required.
C. Set work to required levels and lines, plumb, true.
   1. Shim as required.
   2. Cut and fit accurately.

D. Provide wood nailers or blocking where required for attachment of other work and surface applied items.
   1. Form to shapes indicated or required.
      a. FRTM lumber:
         1) Do not rip or mill.
         2) Cross-cutting and drilling are allowable in accordance with manufacturer's recommendations and UL requirements.
         3) Resurfacing, planing or fabrication of special shapes or profiles shall be done prior to treatment.
      b. FRTM plywood:
         1) Cross-cutting, ripping and drilling are allowable in accordance with manufacturer's recommendations and UL requirements.
         2) Light sanding as permitted by UL to remove raised grain or prepare for finishing is allowable.
   2. Install roofing nailers as indicated:
      a. Install per roofing manufacturer's recommendations.
      b. Match height of nailers to insulation.
      c. Anchor nailers to resist force of 300 PLF unless required otherwise by roofing manufacturer.
         1) Concrete decking attachment:
            a) Attach base nailer to concrete roof deck using minimum 3/8 IN stainless steel adhesive anchors with minimum 3 IN embedment.
            b) Countersink heads of bolts flush with top of nailer.
            c) Provide spacing of minimum 3/8 IN stainless steel adhesive anchors as required to meet loading criteria specified.
         d. Provide 1/2 IN vent spaces between lengths of nailers.
      e. Install nailers over vapor retarder where indicated.

E. When wood has been exposed to moisture allow to completely dry out prior to covering with additional wood or another material.

F. Correct or replace wood which shows bowing, warping or twisting to provide a straight, plumb and level substrate for applications of other materials.

END OF SECTION
SECTION 06610
FIBERGLASS REINFORCED PLASTIC FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fiberglass reinforced plastic (FRP) fabrications including but not limited to:
      a. Solid plate.
      b. Railings.
      c. Modular framing system.
      d. Grating.
      e. Stairs.
      f. Structural members.
      g. Supporting structure design.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 05505 - Metal Fabrications.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
   2. Occupational Safety and Health Administration (OSHA):
      a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
   3. Building Code:
      a. International Code Council (ICC):

1.3 DEFINITIONS

A. Skid-Resistant:
   1. Manufacturer's standard applied abrasive grit coating.
   2. Abrasive coated tape is not acceptable.

B. FRP: Fiberglass Reinforced Plastic.

C. Guardrail: A system of building components located near the open sides of elevated walking surfaces for the purpose of minimizing the possibility of an accidental fall from the walking surface to the lower level.

D. Handrail: A railing provided for grasping with the hand for support.

E. Railing: A generic term referring to guardrail, handrail and/or stair rails.

F. Stair Rail: A guardrail, installed at the open side of stairways with either a handrail mounted to the inside face of the guardrail, or where allowed by applicable codes, with the top rail mounted at handrail height and serving the function of a handrail.
1.4 SYSTEM DESCRIPTION

A. All fiberglass reinforced plastic support systems shall be designed by a registered Professional Structural Engineer licensed in the State of South Dakota.

1.5 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Manufacturer's recommendations on reinforcing field cut openings.
   3. Fabrication and/or layout drawings.
      a. Plan showing profile, location, section and details of each item including anchorage or support system(s).
      b. Locations and type of expansion joints.
      c. Materials of construction including shop applied coatings.
      d. Listing of all accessory items being provided indicating material, finish, etc.
   4. Certifications:
      a. Certification of Structural Engineer's qualifications.
      b. Certification that all components and systems have been designed and fabricated to meet the loading requirements specified.
   5. Manufacturer's full line of colors available for each component.

B. Informational Submittals:
   1. Complete design calculations of all supporting structure and fastening conditions.
      a. Design calculations to be for information only.
      b. Engineer will not review or take any action on submittal.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and handle each item to preclude damage.
B. Store all items on skids above ground.
   1. Keep free of dirt and other foreign matter which will damage items or finish and protect from corrosion and UV exposure.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Railings, stairs, grating and solid plate:
      a. American Grating.
      b. Enduro Composite Systems.
      c. Fibergrate Composite Structures, Inc.
      d. IKG Industries.
      e. International Grating Inc.
      f. Seasafe, Inc.
      g. Strongwell.
   2. Structural shapes:
      a. American Grating.
      b. Enduro Composite Systems.
      c. Fibergrate Composite Structures, Inc.
      d. Strongwell.
3. Modular framing system:
   a. AICKIN.
   b. Enduro Composite Systems.
   c. Seasafe, Inc.
   d. Unistrut.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. Fiberglass Reinforced Plastic (FRP):
   1. Vinyl ester with fiberglass reinforcing.
      a. Type V.
   2. Fire retardant.
      a. Flame spread: ASTM E84, 25 or less.
   3. Color: To be selected by Engineer when more than one (1) color is available for any one (1)
      component.

B. Fasteners, Clips, Saddles, and Miscellaneous Components:
   1. Fiberglass where possible.
   2. Stainless steel may be used if fiberglass component is not available.

C. Adhesive: Recommended by manufacturer.

D. Skid-resistant Surfacing: Manufacturer-applied abrasive grit coating.

2.3 FABRICATION

A. General:
   1. Verify field conditions and dimensions prior to fabrication.
   2. Preassemble items in shop to greatest extent possible.
   3. All components shall be treated with UV inhibitor.
   4. Drill or punch holes with smooth edges.

B. Railings:
   1. Custom fabricate handrail and guardrail to profiles and dimensions indicated on Drawings.
   2. Where not indicated on Drawings, set intermediate horizontal rails to requirements of
      Building Code.
   3. Minimum 2 IN SQ x 0.187 IN tube.
   4. Kickplate:
      a. 4 x 1/2 IN (corrugated) x 0.125 IN thick.
      b. Provide at all elevated platforms and where required by OSHA Standards.
   5. Provide handrail supports at 4 FT maximum spacing for wall brackets and 4 FT maximum
      spacing for posts.
      a. Provide vertical supports at 4 FT maximum spacing on all inclined rail sections.
      b. Provide brackets which provide a 1-1/2 IN projection from finish wall surface or
         guardrail to wall or guardrail side of rail.
   c. Handrails shall not project more than 4-1/2 IN into required stairway width.
   6. Fit exposed ends of guardrails and handrails with solid terminations.
      a. Return ends of handrail to wall but do not attach end to wall.
      b. Where guardrail terminates at a wall or other obstruction, provide a vertical support
         post located 4 IN off wall or obstruction to center of post.
   7. Design railings to resist loading as required by the Building Code.
   8. Form connections with flush, smooth, hairline joints.
      a. Provide concealed splice fitting at all connections.
      b. Top rail splices and expansion joints shall be located within 8 IN of support.
   9. Fabricate items free of blemishes, seam marks, roller marks, rolled trade names and
      roughness.
   10. Provide removable railing where indicated.
C. Grating and Solid Plate Material:
   1. Design live load:
      a. 100 psf uniform live load.
      b. 300 LBS concentrated load.
      c. Maximum deflection of 1/300 of span under a superimposed live load.
      d. Design for the most severe loading condition noted above.
   2. Minimum grating depth: 1-1/2 IN.
   3. Bar span: Maximum of 1-1/2 IN center to center.

D. Embedded Grating Supports:
   1. Fiberglass.
   2. Size to suit depth of grating.
   3. Provide leg or strap for embedding and anchoring into concrete.
   4. Similar to Strongwell "Duradek Fiberglass Curb Angle."

E. Stairs:
   1. Fabricated to profiles indicated.
   2. Treads: Grating with integral 1 IN skid-resistant nosing.
      a. Provide center reinforcing for treads over 36 IN wide.
   3. Risers:
      a. Solid plate material to match treads.
      b. Provide center vertical reinforcing for risers over 36 IN wide.
   4. Landings:
      a. Grating with manufacturer's standard applied skid-resistant abrasive grit coating.
      1) Provide skid-resistant nosing on leading edge of stairs.
      b. Provide intermediate support as required to meet loading requirements.
   5. Design and fabricate stair, platforms and landings, and all connections to support a 100 psf uniform live load plus a 300 psf concentrated load.
   6. Provide railing per this Specification Section.

F. Sheet Goods: Minimum 1/4 IN thick or as noted on Drawings.

G. Modular Framing System:
   1. Material: Heavy duty pultruded.
   2. Shapes as required for condition.
   3. Fasteners: Stainless steel or fiberglass.
   4. Provide end caps for all exposed terminations.

H. Structural Members:
   1. Provide structural members having the same resin composition as the item being supported.
   2. Factory fabricate with all required connection holes and holes for work of other trades.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Set work accurately in location, alignment and elevation, plumb, level, and true.
   1. Measure from established lines and levels.
   2. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.
   3. Tolerances:
      a. Maximum variation from plumb in vertical line: 1/8 IN in 3 FT.
      b. Maximum variation from level of horizontal line: 1/4 IN in 20 FT.
      c. Maximum variation from plan location: 1/4 IN in 20 FT.
C. Railings:
   1. Adjust railings prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length.
   a. Plumb posts in each direction.
   2. Provide posts with floor flange, attached to post and with predrilled holes for bolting to stringer, floor or beam.
   3. Anchor handrails to walls or guardrails with brackets designed for condition.
      a. For concrete and masonry anchorage, use stainless steel adhesive anchors.
      b. Anchor size and embedment to be designed by component fabricator.
         1) Provide minimum of 1/2 IN anchor bolts.

D. Fabricate FRP sheet goods to shapes and profiles as indicated on Drawings.

E. Fasten railings to beams and stair stringers with stainless steel bolts, nuts and washers.

F. Attach grating to each end and intermediate support clip or saddle with bolts, nuts and washers.
   1. Maximum spacing: 2 FT OC with minimum of two (2) per side.
   2. Attach clips or saddles to bearing bars only.
   3. Reinforce all field cut openings in accordance with manufacturer's recommendations.

G. Attach stair treads at ends to stair stringer with hold-down clips, bolts, nuts, and washers.
   1. Minimum two (2) clips per end.

H. File cut ends of all fiberglass to a 1/32 IN radius.

I. Seal cut ends of all items with catalyzed resin as recommended by manufacturer.
   1. Provide same resin used in fabrication of item.

J. Provide all modular framing components as required to suit condition.
   1. Install in accordance with manufacturer's recommendations.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fluid applied waterproofing.
   2. Protection course.
   3. Specific concrete finishing requirements.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Division 03 - Concrete.
   4. Section 07210 - Building Insulation.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
         Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
      b. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
   2. International Concrete Repair Institute (ICRI):
      a. 310.2, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings,
         and Polymer Overlays.
   3. The Society for Protective Coatings/NACE International (SSPC/NACE):
      a. SP 6/NACE No. 3, Commercial Blast Cleaning.
      b. SP 13/NACE No. 6, Surface Preparation of Concrete.

B. Qualifications:
   1. Applicator(s) licensed or approved in writing by manufacturer.
   2. Applicator(s) shall have minimum of seven (7) years experience in application of cold
      liquid-applied elastomeric waterproofing membranes with minimum of two (2) years
      installation of products specified or accepted for use on this Project.
      a. Provide list of projects completed in last two (2) years using products proposed for use.
      1) Include name of structure, area waterproofed (SF) and name of contact with phone
         number.

C. Miscellaneous:
   1. Manufacturer's authorized representative shall review substrate preparation and provide
      written approval of substrate prior to installation of product.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at
      the Project site.
   2. Installer and applicator are synonymous.
1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Details showing flashing of penetrations, terminations, expansion joints, protection course attachment and other special conditions.
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   5. Applicator's experience record.
   6. Listing of projects completed in last two (2) years.

B. Informational Submittals:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Manufacturer's written approval of substrate.
   3. Warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Waterproofing system:
      a. Tremco Sealants and Waterproofing.
      b. Carlisle Coatings and Waterproofing.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. Primer: Manufacturer's recommended primer appropriate to substrate.

B. Waterproofing System:
   1. One (1) or two (2) component, moisture curing polyurethane elastomer meeting requirements of ASTM C836.
   2. Flowing type for surfaces up to 5 percent slope.
   3. Non-flow type for surfaces exceeding 5 percent.
   4. Carlisle "Liquiseal CCW-525" or Tremco "TREMproof 201/60."

C. Adhesive: Manufacturer's standard.

D. Flashing Reinforcement: Woven uncoated fiberglass mesh.

E. Sealant: Manufacturer's recommended sealant.

F. Protection Course: Extruded polystyrene insulation.
   1. See Specification Section 07210.
   2. Acceptable to waterproofing manufacturer.

G. Backer Rod: Closed cell polyurethane foam rod.
PART 3 - EXECUTION

3.1 PREPARATION

A. Cure concrete and masonry in accordance with manufacturer's recommendations.
   1. Verify moisture content does not exceed manufacturer's maximum allowable.
   2. Ensure that curing agents used are compatible with coating system.

B. Remove surface contamination by high pressure water cleaning per ASTM D4258.

C. Verify that concrete has been troweled and broomed, free of fins, ridges or voids.
   1. Verify that all tie holes and honeycomb areas, holes and voids have been patched in
      accordance with Specification Section 03348 and coating manufacturer's recommendations.

D. Prepare substrate per manufacturer's published instructions and this Specification Section.
   1. Concrete surfaces:
      a. Abrasive blast in accordance with SSPC SP 13/NACE No. 6 to provide a profiled
         surface.
      1) Profile: ICRI 310.2, CSP 3 minimum.
   2. Metal surfaces:
      a. Abrasive blast in accordance with SSPC SP 6/NACE No. 3.
      1) Minimum one (1) mil surface profile.
      b. Prime coat all metal surfaces.
   1. Flash all penetrations and other areas in accordance with manufacturer's instructions.
   4. Clean and seal cracks and joints in accordance with manufacturer's instructions.

E. Protect adjacent surfaces.

3.2 APPLICATION AND INSTALLATION

A. Apply waterproofing system in accordance with manufacturer's printed instructions and this
   Specification Section.
   1. Provide minimum 60 mil dry film thickness.
   2. Apply waterproofing to the exterior side of vertical concrete wall surfaces.
      a. Extend waterproofing horizontally over footings and turn down to bottom of footing.
      b. Terminate top of waterproofing in a saw-cut reglet approximately 4 IN below finished
         grade.

B. Extend coating over all previously flashed areas.

C. Allow vertical applications to cure minimum of 12 HRS at 75 DegF or as recommended by
   manufacturer, prior to backfilling.

D. Protection Course:
   1. Provide perimeter insulation in accordance with Specification Section 07210 and as shown
      on Drawings.
   2. Secure protection course to prevent displacement during backfilling.
      a. Adhere to cured waterproofing membrane.
      b. Mechanical fasteners are not acceptable.

END OF SECTION
SECTION 07190
UNDER SLAB VAPOR RETARDER

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes: Under slab vapor retarder.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE
A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 302.2R, Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
   2. ASTM International (ASTM):
      d. E1643, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
      e. E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.3 SUBMITTALS
A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Product data sheet on vapor retarder sheet and vapor retarder tape.
      c. All accessories proposed for use.
      d. Manufacturer's installation instructions.
      e. Manufacturer's recommendation on vapor retarder tape.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Vapor retarder:
      a. Fortifiber Corporation.
      b. Layfield Group
      c. Raven Industries.
      d. Reef Industries.
      e. Stego Industries.
      f. WR Meadows, Inc.
2.2 PERFORMANCE REQUIREMENTS

A. Vapor Retarder:
1. ASTM E1745, Class A.
2. Thickness: Minimum 15 mil.
3. Water vapor permeance: 0.03 maximum per ASTM E96.
5. Minimum tensile strength: 45 LBS/IN, ASTM D882.

2.3 ACCESSORIES

A. Pipe Boots: Manufacturer's standard boot fabricated to maintain the integrity of the vapor retarder system.
B. Vapor Retarder Tape: As recommended by vapor retarder manufacturers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions, ASTM E1643 and ACI 302.2R.
B. Provide vapor retarder where indicated on the Drawings.
   1. Place continuous vapor retarder above granular fill subgrade material, unless noted otherwise.
C. Lap minimum 6 IN and seal in accordance with ASTM E1643 and manufacturer's recommendations.
D. Extend to extremities of area and seal to adjacent elements.
E. Seal all penetrations: Provide pipe boot for all pipes or conduit penetrating the floor slab.

3.2 FIELD QUALITY CONTROL

A. Ensure proper precautions are implemented to prevent damage to installed vapor retarder membrane prior to and during pouring of concrete floor slab.
B. Inspect vapor retarder immediately prior to placement of concrete.
   1. Patch all punctures, tears, holes, etc.
      a. Repair with additional layer of vapor retarder and seal entire patch with vapor retarder tape or as recommended by manufacturer.
      b. Lap all repairs minimum 6 IN.

END OF SECTION
SECTION 07210
BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Building insulation.
      a. Does not include roof insulation or roof vapor retarder; see Specification Section07534.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 04220 - Concrete Masonry.
   4. Section 07534 - Adhered Elastomeric (EPDM) Sheet Roofing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
         Sandwich Constructions
   2. Underwriters Laboratories, Inc. (UL):

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Manufacturer's recommendations on sealants and mastics.

B. Informational Submittals:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Certification from insulation manufacturer stating that insulation proposed is acceptable for
      intended use per the Drawings.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contact Documents, the following manufacturers are acceptable:

1. Rigid extruded polystyrene board insulation:
   a. Dow.
   b. Dyplast Products.
   c. Diversifoam Products.
   d. PACTIV.
   e. Owens Corning.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. Rigid Polystyrene Board Insulation:

1. Extruded: ASTM C578, Type IV.
   a. Water vapor transmission: ASTM E96, 1.1 perm-IN maximum.
   b. Water absorption: ASTM C272, 0.3 percent maximum.
   c. Thermal resistance: ASTM C518 at 75 DegF mean temperature, 5.0/IN.

2. Provide insulation designed for intended use.
   a. Perimeter insulation and protection board.
      1) Similar to Dow "STYROFOAM."
      3) Thickness:
         a) Perimeter insulation: 2 IN.
         b) Cavity insulation:
            1) Similar to Dow "CAVITYMATE."
            2) Compressive strength: ASTM D1621, 15 psi.
            3) Thickness: 2 IN.
            4) Edges: Square.
   b. Cavity insulation:
      1) Similar to Dow "CAVITYMATE."
      2) Compressive strength: ASTM D1621, 15 psi.
      3) Thickness: 2 IN.
      4) Edges: Square.

B. Sealant and Mastic: Manufacturer's recommended product.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. General:

1. Insulate full thickness over surfaces to be insulated.
2. Fit tightly around obstructions or penetrations.
   a. Fill voids with expanding foam sealant.
      1) See Specification Section 07900.
3. Cover all penetrations (electrical junction boxes, switch boxes, piping, conduits, etc.) with insulation, taking care not to compromise the workings of the device.
4. Fit butted joints tightly together.
5. Do not use broken or torn pieces of insulation.

1. Install so that completed installation is vapor tight.
   a. Seal all joints.
   b. Seal to abutting materials to maintain vapor retarder integrity.
   c. Provide manufacturer’s recommended solvent-free sealant compatible with insulation.
      1) Tape is not acceptable for use with rigid board insulation.
C. Cavity Insulation:
   1. Do not proceed with installation until subsequent work which conceals insulation is ready to be performed.
   2. Set each piece of insulation flush with the abutting piece to eliminate ledges in the face of the insulation.
   3. Install mastic on face of concrete or masonry back-up in accordance with mastic and insulation manufacturer's recommendation.
   4. Press courses of insulation between wall ties (horizontal reinforcing) with edges butted tightly both ways.
   5. Set units firmly into mastic.
   6. Seal all horizontal and vertical joints with sealant recommended by insulation manufacturer.
   7. Do not use damaged insulation.

D. Perimeter Insulation:
   1. Install insulation below grade on outside face of foundation walls.
      a. Install in mastic with tight joints.
   2. Extend insulation down to top of footing as indicated on Drawings.
   3. Protect insulation from damage and/or displacement during backfilling.

3.2 FIELD QUALITY CONTROL
A. Repair or replace damaged insulation as directed by Engineer.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Adhered elastomeric roofing.
   2. Roof insulation.
   3. Vapor retarder.
   4. Cover board.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 06100 - Rough Carpentry.
   4. Section 07600 - Flashing and Sheet Metal.
   5. Division 15 - Mechanical.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
   2. FM Global (FM):
      a. Approval Guide:
         1) 1-28, Design Wind Loads.
   3. Underwriters Laboratories, Inc. (UL):

B. Qualifications:
   1. Applicator factory trained and approved in writing by roofing manufacturer.
   2. Applicator shall have a minimum of 10 years experience installing roof membrane systems similar to system specified.
      a. Minimum of five (5) years of the 10 years experience shall have been spent installing roof systems manufactured by the company proposed for use.
1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at
      the Project site.
   2. Installer and applicator are synonymous.

1.4 SYSTEM DESCRIPTION

A. Fully adhered single-ply roofing system over concrete deck, including but not limited to:
   1. Vapor retarder.
   2. Roof insulation.
   3. Cover board.
   5. Flashings, penetrations and/or other materials necessary for a complete installation.

1.5 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Fabrication and/or layout drawings:
      a. Scaled outline of roof showing slopes, edge details, penetrations and details, and any
         special condition not covered on the Drawings.
         1) Minimum plan scale: 1/8 IN = 1 FT.
         2) Minimum detail scale: 1-1/2 IN = 1 FT.
      b. Provide tapered insulation shop drawings illustrating installation patterns and
         dimensions for each tapered module.
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Product data sheet on all components of roof system.

B. Maintenance Information:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.

C. Informational Submittals:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Certifications Prior to Installation:
      a. Certification of applicator qualifications.
      b. Certificates showing testing agency approval of assembly for ratings indicated.
      c. Letter from roofing manufacturer and insulation manufacturer stating that roof
         insulation being used is compatible with roofing system and will perform properly for
         intended use.
      d. Letter from mechanical fastener manufacturer stating that fasteners being used are
         compatible with roofing system and will perform properly for intended use.
      e. Letter from roofing manufacturer and insulation manufacturer stating that treated wood
         specified is compatible with roofing system and is acceptable for intended use.
      f. Letter from adhesive manufacturer and insulation manufacture stating that adhesive
         being used is compatible with roof insulation and will perform properly for intended
         use.
   3. Certifications for final closeout:
      a. Certification by roofing manufacturer’s representative that roof has been installed
         properly.
      b. Warranty.
1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

B. Store membrane rolls lying down on pallets and fully protected from the weather with clean canvas tarpaulins.
   1. Unvented polyethylene tarpaulins are not acceptable.

C. Store adhesives at temperatures recommended by manufacturer.

D. Replace all materials that become damaged during storage prior to installation.
   1. Remove damaged material from the Site.

E. Store insulation in accordance with PIMA recommendations, indoors or above ground and protected from the elements.
   1. Protect insulation stored outdoors with breathable, waterproof tarpaulins.
   2. Provide dunnage as necessary to keep insulation minimum 3 IN above grade or roof deck.
   3. Protect insulation from direct exposure to sunlight.
   4. Remove damaged insulation from the jobsite.

1.7 WARRANTY

A. Manufacturer's 10 year labor and materials watertight warranty signed by roofing material's manufacturer and applicator.
   1. Warranty to cover all materials provided by roofing manufacturer.
   2. Warranty to include provision to allow Owner to make emergency repairs.
   3. Provide extended peak gust wind speed coverage up to 72 mph.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Roofing system:
      a. Carlisle Syntech Systems Inc.
      b. Firestone Building Products Co.
      c. Gen Corp.
   2. Vapor retarder:
      a. As recommended by roofing manufacturer.
   3. Adhesive:
      a. As recommended by roofing manufacturer and approved by insulation manufacturer.
   4. Polyisocyanurate insulation:
      b. Carlisle Syntech Systems Inc.
      c. Firestone Building Products Co.
      d. Johns-Manville.
   5. Other materials:
      a. Manufacturers as noted.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 DESIGN CRITERIA

A. Roof Assembly Design Criteria:
   1. Fire resistance:
      a. UL Class A roof covering.
2. Hail and wind uplift resistance:
   a. FM 1-28: Class 1-90.

2.3 SYSTEM COMPONENTS

A. Use only materials approved by roofing materials manufacturer.

B. Roofing Membrane:
   1. EPDM rubber sheet.
      a. ASTM D4637.
      b. 0.060 IN thick.
      c. Color: Black.

C. Cover Board:
   2. Water and moisture-resistant treated gypsum core.
      a. Top surface shall be pre-primed to enhance adhesion.
   3. Glass mat facing front and back.
   5. Class 'A' fire rated per UL 790.
   6. Flame spread 15 and smoke developed 0 when tested in accordance with ASTM E84 or
      UL 723.
   7. Thickness:
      a. 1/4 IN.
      b. Size: 4 x 4 FT or 4 x 8 FT.
      a. If acceptable to roofing manufacturer, un-primed coverboard may be used with
         manufacturer’s recommended field-applied primer.

D. Roof Insulation:
   1. Rigid polyisocyanurate foam boards.
   2. ASTM C1289, Class 1, Type II.
      a. Coated glass facers.
      c. Water absorption, ASTM C209, less than 1.0 percent.
      d. Water vapor transmission: ASTM E96, less than 1.0 perm.
      e. Thermal resistance (LTTR R-Value): ASTM C1289, minimum 5.7/IN.
   4. Tapered Insulation: 1/4 IN/FT.

E. Vapor Retarder:
   1. Maximum perm rating: 0.10 gms H20/100 SQ IN/24 HRS, ASTM E96, Procedure A.
   2. Acceptable to roof membrane manufacturer and insulation manufacturer.
   3. Compatible with adhesives being used.

F. Membrane Flashing: 0.060 IN thick EPDM.
   1. Provide manufacturer's standard prefabricated pipe flashing, inside and outside flashing
      corners or other profile as necessary for conditions to be flashed.
   2. Where profile of element being flashed or other field conditions preclude the use of
      prefabricated flashings, provide manufacturer’s standard “pourable sealant pocket”.
      a. Sealant Pocket Filler:
         1) Grout: Cement based.
         2) Sealant/filler: Manufacturer’s recommended urethane sealant made specifically for
            filling in voids.
   3. Termination Bars:
      a. Extruded aluminum bar with predrilled holes at 8 IN OC.
      b. Size: 2-1/4 IN deep by 0.10 IN thick.

G. Wood Blocking and Nailers: See Specification Section 06100.
H. Adhesives, Tapes, Cements and Sealants: Roofing manufacturer's standard.

I. Provide all miscellaneous accessories as required.

J. Fasteners:
   1. Ferrous components:
      a. Test in accordance with ASTM D6294.
      b. Meet or exceed FM 4470.
   2. Provide stainless steel for all exposed fasteners.

2.4 ACCESSORIES

A. Use manufacturer's standard prefab rubber accessories where available.
   1. Nailing strips: As detailed and required by manufacturer.
   2. Pipe flashings: Provide for each pipe penetration; include all clamps and adhesive.
   3. Pipe, duct and conduit supports:
      a. 100 percent recycled rubber.
         1) Density: ASTM C642, minimum 0.50 OZ/cubic IN.
         2) Compressive deformation:
            a) ASTM D395.
            b) 5 percent at 70 psi and 72 DegF.
         3) Brittleness at low temperature: ASTM D746, -50 DegF.
         4) Weathering: ASTM D573, 70 HRS at 120 DegF.
      b. Uniform load capacity: 500 LBS per lineal FT.
      c. Size:
         1) Width: 6 IN.
         2) Length and height as necessary for item being supported.
      d. Compatible with modular framing.
      e. Provide modular framing, pipe supports, pipe clamps or other accessories as necessary
         for items being supported.
      f. See Division 15 and Specification Section 16010 as applicable.
   f. Similar to Cooper B-Line "DURA-BLOK."

2.5 MAINTENANCE MATERIALS

A. Provide Owner with patch repair kit containing as a minimum.
   1. Lap sealant.
   2. Piece of roofing membrane 2 x 2 FT.
   3. Adhesive and primer.

B. Instruct Owner's personnel on making emergency patch and repairs to roof.

C. Owner to notify roofing manufacturer within three (3) working days if emergency repairs are
   made by Owner personnel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide wood nailers and blocking as necessary for a complete installation.

C. Installation of Vapor Retarder:
   1. Install vapor retarder over decking, using adhesive recommended by roofing manufacturer.
      a. Extend up face of parapet wall to top of insulation.
   2. Lap side joints 4 IN, lap ends 6 IN and seal all laps with adhesive,.
   3. Repair all damage and tears in accordance with vapor retarder manufacturer's
      recommendations.
D. Provide roofing manufacturer’s recommended sleeper at all duct support structures, condensing units or similar equipment.
   1. Fasten sleeper to deck as necessary to resist uplift.
   2. Flash sleeper to roof membrane as recommended by roofing manufacturer.

E. Installation of Insulation:
   1. Cut insulation neatly to fit around all roof penetrations and projections.
   2. Butt joints tightly.
   3. Attach insulation using adhesive in accordance with manufacturer's recommendations for uplift rating required.
   4. Provide tapered insulation where shown or necessary.
   5. Provide cricket behind all roof penetrations larger than 12 IN.

F. Installation of Cover Board:
   1. Lay cover board over top of insulation tightly butted and cut to fit around all penetrations.
      a. Stagger end joints 12 IN minimum.
   2. Attach cover board using adhesive in accordance with manufacturer's recommendations for uplift rating required.
   3. Calk around all penetrations with sealant acceptable to insulation and roof membrane manufacturer.
   4. Do not install cracked or broken boards.
      a. Trim damaged boards to provide straight edges and square corners.

G. Installation of Roofing:
   1. Install roofing using adhesive recommended by roofing manufacturer.
   2. Seal seams with lap sealant same day they are laid.
      a. Extend roofing or flashing up face of parapet, over top of wood blocking and seal to face of wall in accordance with manufacturer's standard details.
         1) Provide in one (1) piece with no horizontal joints.
   3. Install flashing at all vertical surfaces, roof interruptions and penetrations.
      a. Flash all roof penetrations in accordance with roofing manufacturer's standard details.

3.2 FIELD QUALITY CONTROL

A. Provide services of manufacturer's field service representative as required.
B. Protect installed insulation from water using water cut-offs in bad weather and at end of work period.
C. Remove and replace wet insulation and cover board.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Architectural flashing and sheet metal work.
   2. Factory formed coping system.
   3. Prefinished scuppers, conductor heads and downspouts.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 04155 - Masonry Accessories.
   4. Section 07534 - Adhered Elastomeric (EPDM) Sheet Roofing.
   5. Section 07900 - Joint Sealants.
   6. Section 09905 - Painting and Protective Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Architectural Manufacturers Association (AAMA):
      a. 2605, Voluntary Specification, Performance Requirements and Test Procedures for
         Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
   3. ASTM International (ASTM):
         Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   4. FM Global (FM).
   5. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):

B. Qualifications:
   1. Sheet metal fabricator shall have minimum 10 years experience in fabrication of sheet metal
      items similar to items specified.
   2. Sheet metal installer shall have minimum five (5) years experience installing sheet metal
      items specified.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at
      the Project site.
   2. Installer and applicator are synonymous.

B. PVDF: Polyvinylidene fluoride.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
3. Fabrication and/or layout drawings.
   a. Scaled drawing showing expansion joint locations, special conditions, profile, fastening
      and jointing details.
   1) Minimum plan scale: 1/8 IN = 1 FT.
   2) Minimum detail scale: 1-1/2 IN = 1 FT.
4. Fabricator qualifications.
5. Installer qualifications.

B. Samples:
   1. Submit two (2) minimum 2 IN x 3 IN colored metal samples for each proposed to match
      existing.

C. Informational Submittals:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Warranty: Manufacturer's sample warranty language.

1.5 WARRANTY

A. Provide listed manufacturer's standard 20 year finish warranty against fading, chipping, cracking
   and peeling.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are
   acceptable:
   1. Pre-finished sheet metal:
      a. Carlisle.
      b. Firestone Building Products.
      c. Peterson Aluminum Corp.
   2. Factory-formed coping system.
      a. W.P. Hickman Co.
      b. Metal Era, Inc.
   3. Butyl sealant:
      a. Pecora.
      b. Sika.
      c. Tremco.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. Sheet Metal:
      a. Type 316.

B. Fasteners: Non-ferrous compatible with sheet metal.

C. Sealants:
   1. Non-curing Butyl Sealant:
      a. Pecora “BA-98”.
      b. Sika “SikaLastomer 511”.
      c. Tremco “TremPro JS-773”.

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07600 - 2

D. Dissimilar Metal Protection: Comply with Specification Section 09905.

2.3 MANUFACTURED ITEMS

A. Factory Formed Coping System:
   1. Formed coping piece which locks to anchor plate fastened to top of wall.
   2. ANSI/SPRI ES-1 tested.
   3. FM approved.
   4. Coping cover:
      a. Aluminum.
      1) Thickness: 0.050 IN.
   5. Anchor plate: Stainless steel, minimum 20 GA.
   6. Splice plates: Aluminum, minimum 0.032 IN.
      a. Continuous, minimum 6 IN long.
      b. Front and back legs with extruded butyl seal.
      c. Finish: Match coping.
   7. Factory fabricated accessories, including but not limited to:
      a. Corners, end caps, end terminations.
      b. All accessories to be factory mitered and welded.
   8. Profile:
      a. Metal-Era "Perma-Tite Tapered."
      b. Front leg: 6 IN.
      c. Back leg: 5 IN.

B. Finish:
   1. PVDF coating with minimum 70 percent resin content.
      a. Meet requirements of AAMA 2605.
      1) Color: Dark Bronze to match existing.

2.4 ACCESSORIES

A. Accessories as required to form a complete water and airtight system.

2.5 FABRICATED ITEMS

A. General:
   1. Shop fabricate items to maximum extent possible.
      a. Fabricate true and sharp to profiles and sizes indicated on Drawings.
      1) Shop fabricate and weld or solder all corners.
   2. Fasteners: Non-ferrous compatible with sheet metal.
   3. Fabricate scuppers, conductor heads , downspouts and similar items using pre-finished aluminum, unless noted otherwise.
   4. Prefinished aluminum:
      a. Thickness: Minimum 0.050 IN.
      b. Texture: Smooth .
      c. Coated on exposed face with PVDF coating having a minimum 70 percent resin content and a minimum 1.0 mil dry film thickness.
      1) Meet requirements of AAMA 2605.
      2) Color: Match coping.

B. Overflow Scuppers:
   1. Roofing manufacturer’s recommended through-wall scupper design.
      a. Refer to Specification Section 07534.
      b. Size and location(s) as shown on Drawings.

C. Scupper and Conductor Head:
   1. Roofing manufacturer’s recommended through-wall scupper design.
      a. Size and location(s) as shown on Drawings.
2. Conductor head profile per SMACNA Figure 1-25F.
   a. Provide 1 IN x 4 IN overflow opening with drip edge on front face of conductor.
3. 4 IN long outlet tube.
   a. Size and shape to match downspout.
4. Debris screen:
   a. Installed in top of conductor head.
   b. 1/4 x 1/4 IN aluminum mesh screen.
   c. Screen shall be removable without damage to screen or conductor head.

D. Retainer Clips and Continuous Cleats: 0.050 IN stainless steel.

E. Downspouts:
   1. Rectangular open-face style similar to SMACNA Figure 1-32E.
   a. Horizontal cross brace at 5 FT maximum spacing.
   2. Fabricated in longest practical lengths.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide items to be built into other construction to Contractor in time to allow their installation.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions, SMACNA, and as indicated on Drawings.

B. Weld aluminum to achieve weathertight joints and required details.
   1. Do not weld slip joints.
   2. Touch-up damaged prefinished items.

C. Set top edges of membrane flashing and sheet metal flashing into masonry joint wherever practicable.
   1. Surface applied terminations will be allowed only where specifically detailed or otherwise approved in writing by the Engineer.
   2. Provide counterflashing at all flashing terminations.
   3. Seal terminations and counterflashing in accordance with Specification Section 07900.

D. Fasten materials at intervals recommended by SMACNA.

E. Install slip joints to allow for thermal movement as recommended by SMACNA and manufacturer.
   1. Maximum spacing: 10 FT OC.
   2. Provide slip joint 24 IN from corners.
   3. Seal slip joints with two (2) beads of non-curing butyl sealant on each side of slip joint overlap.

F. Form flashings to provide spring action with exposed edges hemmed or folded to create tight junctures.

G. Provide dissimilar metals and materials protection where dissimilar metals come in contact or where sheet metal contacts mortar, concrete masonry or concrete.

H. Provide all miscellaneous sheet metal items not specifically covered elsewhere, as indicated or required to provide a weathertight installation.
   1. Provide all components necessary to create weather-tight junctures between roofing and sheet metal work.

I. Installation of Scupper and Conductor Head:
   1. Flash the opening in the parapet wall and install the scupper and conductor head as indicated in SMACNA Figure 1-27A.
2. Seal all joints to provide complete weathertight installation.
3. Flash roofing material onto scupper per roofing manufacturer's recommendations.
   a. See Specification Section 07534.

J. Installation of Downspouts:
1. Install downspouts in locations shown on the Drawings.
2. Provide downspout anchor straps per SMACNA Figure 1-35 as appropriate for downspout style.
3. Provide gutter to downspout connection per SMACNA Figure 1-33B, Detail 1.
4. Seal all joints in downspout for a complete watertight system.
5. Angle bottom of downspout out away from building to direct discharge onto concrete splashblock.
6. Anchor hanger straps to building wall with stainless steel screws and anchor sleeves appropriate for wall construction.
   a. Provide minimum of two (2) anchors per strap.
7. Maximum spacing of hanger straps shall be 10 FT with minimum of two (2) hanger straps per vertical piece of downspout.
8. Spacing and location of hanger straps shall be consistent from downspout to downspout.

END OF SECTION
SECTION 07900
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sealant work.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 09905 - Painting and Protective Coatings.

C. Work included consists of but is not necessarily limited to:
   1. Sealing all joints which will permit penetration of dust, air or moisture, unless sealing work
      is specifically required under other Specification Sections.
      a. Work includes but is not limited to:
         1) Flashing, counterflashing and retainers.
         2) Masonry control joint sand between masonry and other materials.
         3) Isolation joints.
         4) Joints between paving or sidewalks and building.
         5) Concrete construction, control and expansion joints.
         6) Joints between precast roof units and between precast roof units and walls.
         7) Penetrations of walls, floors and decks.
         8) Perimeters of door and window frames, louvers, grilles, etc.
         9) Thresholds.
         10) Other joints where sealant, expanding foam sealant or compressible sealant is
             indicated.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 302.1R, Guide for Concrete Floor and Slab Construction.
   2. ASTM International (ASTM):
      b. C1521, Standard Practice for Evaluating Adhesion of Installed Weatherproofing
         Sealant Joints.

B. Qualifications: Sealant applicator shall have minimum five (5) years experience using products
   specified on projects with similar scope.

1.3 DEFINITIONS

A. Corrosive Areas Include: Entire site is considered Corrosive.

B. Defect(ive): Failure of watertightness or airtightness.

C. Finish sealant: Sealant material per this specification applied over face of compressible sealant
   or expanding foam sealant specified, to provide a finished, colored sealant joint.

D. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at
      the Project site.
   2. Installer and applicator are synonymous.
E. "Interior wet areas": Entire area is considered wet.
F. "Seal," "sealing" and "sealant": Joint sealant work.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Manufacturer's recommendations for joint cleaner, primer, backer rod, tooling and bond breaker.
   3. Certification from sealant manufacturer stating product being used is recommended for and is best suited for joint in which it is being applied.
   4. Certification of applicator qualification.

B. Test Results:
   1. Provide adhesion test results for each sealant sample including adhesion results compared to adhesion requirements.
   2. Manufacturer's authorized factory representative recommended remedial measures for all failing tests.

C. Informational Submittals:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original unopened containers with labels intact: Labels shall indicate contents and expiration date on material.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Compressible sealant:
      b. Emseal.
      c. Norton.
      d. Sandell.
   2. Expanding foam sealant:
      a. Macklanburg Duncan.
      b. Convenience Products.
      c. FAI International, Inc.
      d. Power Fasteners.
   3. Polyether sealants:
      a. BASF Sonneborn.
      b. ChemLink, Inc.
   4. Polysulfide rubber sealant:
      a. Pecora.
      b. BASF Sonneborn.
      c. PolySpec
   5. Polyurethane sealants:
      a. Pecora.
b. Sika Chemical Corp.
c. BASF Sonneborn.
d. Tremco.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. Sealants - General:
1. Provide colors matching materials being sealed.
2. Where compound is not exposed to view in finished work, provide manufacturer's color which has best performance.
3. Nonsagging sealant for vertical and overhead horizontal joints.
4. Sealants for horizontal joints: Self-leveling pedestrian/traffic grade.
5. Joint cleaner, primer, bond breaker: As recommended by sealant manufacturer.
6. Sealant backer rod and/or compressible filler:
   a. Closed cell polyethylene, polyethylene jacketed polyurethane foam, or other flexible, nonabsorbent, non-bituminous material recommended by sealant manufacturer to:
      1) Control joint depth.
      2) Break bond of sealant at bottom of joint.
      3) Provide proper shape of sealant bead.
      4) Serve as expansion joint filler.

B. Compressible Sealant:
1. Foamed polyurethane strip saturated with polymerized polybutylene waterproofing coated on front face with nonreactive release agent that will act as bond breaker for applied sealant.
   a. Polytite Manufacturing Corp. "Polytite-B."
2. Adhesive: As recommended by sealant manufacturer.

C. Expanding Foam Sealant:
1. One (1) or two (2) component fire rated moisture cured expanding urethane.
2. Shall not contain formaldehyde.
3. Density: Minimum 1.5 pcf.
4. Closed cell content: Minimum 70 percent.
5. R-value: Minimum 5.0/IN.
7. Smoke developed: Less than 25.

D. Polyether Sealant:
1. Silyl-terminated polyether polymer.
2. ASTM C920, Type S, Grade NS, Class 50, Use NT, M, A, and O.
   a. BASF Sonneborn Sonolastic 150 with VLM Technology.
   b. ChemLink DuraLink.

E. Polysulfide Rubber Sealant:
1. One (1) or two (2) component.
   a. Pecora Synthacalk GC2+.
   b. BASF Sonneborn - Sonolastic Polysulfide Sealant.
   c. PolySpec THIOKOL 2235.

F. Polyurethane Sealant:
1. One (1) or two (2) components.
2. Paintable.
3. Meet ASTM C920 Type S or Type M, Grade NS or P, Class 25, Use NT, T, M, A and O.
   b. Sika Chemical Corporation Sikaflex-1a, Sikaflex-2C NS/SL.
   c. BASF Sonneborn Sonolastic NP-1, NP-II, SL-1 SL-2.
   d. Tremco Dymonic or Dymeric, Vulkem 116,227,45,245.
PART 3 - EXECUTION

3.1 PREPARATION

A. Before use of any sealant, investigate its compatibility with joint surfaces, fillers and other materials in joint system.

B. Use only compatible materials.

C. Where required by manufacturer, prime joint surfaces.
   1. Limit application to surfaces to receive sealant.
   2. Mask off adjacent surfaces.

D. Provide joint depth for joints receiving polyurea joint filler in accordance with manufacturer's recommendations.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Clean all joints.

C. Make all joints water and airtight.

D. Make depth of sealing compounds, except expanding foam and polyurea sealant, not more than one-half width of joint, but in no case less than 1/4 IN nor more than 1/2 IN unless recommended otherwise by the manufacturer.

E. Provide correctly sized backer rod, compressible filler or compressible sealant in all joints to depth recommended by manufacturer:
   1. Take care to not puncture backer rod and compressible filler.
   2. Provide joint backer rod as recommended by the manufacturer for polyurea joint filler.

F. Apply bond breaker where required.

G. Tool sealants using sufficient pressure to fill all voids.

H. Upon completion, leave sealant with smooth, even, neat finish.

I. Where piping, conduit, ductwork, etc., penetrate wall, seal each side of wall opening.

J. Install compressible sealant to position at indicated depth.
   1. Size so that width of material is twice joint width.
   2. Take care to avoid contamination of sides of joint.
   3. Protect side walls of joint (to depth of finish sealant).
   4. Install with adhesive faces in contact with joint sides.
   5. Install finish sealant where indicated.

K. Install expanding foam sealant to minimum 4 IN depth or thickness of wall being penetrated if less than 4 IN or as indicated on Drawings.
   1. Provide adequate fire rated backing material as required.
   2. Hold material back from exposed face of wall as necessary to allow for installation of backer rod and finish sealant.
      a. Allow expanding foam sealant to completely cure prior to installing backer rod and finish sealant.
   3. Trim off excess material flush with surface of the wall if not providing finished sealant.

3.3 FIELD QUALITY CONTROL

A. Adhesion Testing:
   1. Perform adhesion tests in accordance with ASTM C1521 per the following criteria:
      a. Chemical containment areas: One (1) test per every 10 LF of joint sealed.
      b. Masonry control joints: One (1) test per every 50 LF of joint sealed.
c. All other type of joints except butt glazing joints: One (1) test per every 30 LF of joint sealed.
d. Manufacturer's authorized factory representative shall recommend, in writing, remedial measures for all failing tests.

3.4 SCHEDULE

A. Furnish sealant as indicated for the following areas:

1. Exterior areas:
   a. Above grade: Polyether.
   b. Below grade: Polyurethane.

2. Interior areas:
   b. Sealant exposed to or having the potential of being exposed to hypochlorite liquid or fumes: Polysulfide.

3. Immersion:
   a. Prolonged contact with or immersion in:
      1) Non-potable water, wastewater or sewage: Polysulfide.


5. Exterior wall penetrations: Expanding urethane foam, with finish sealant.
   a. Finish sealant:
      1) Exterior side:
         a) Above grade: Polyether.
         b) Below grade: Polyurethane.
      2) Interior side: Polysulfide.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flush aluminum doors.
   2. Aluminum frames.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 07900 - Joint Sealants.
   4. Section 08700 - Finish Hardware.
   5. Section 09905 - Painting and Protective Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Aluminum Association (AA):
   3. American National Standards Institute (ANSI):
   4. ASTM International (ASTM):
   6. Door and Hardware Institute/American National Standards Institute (DHI/ANSI):
   7. Glass Association of North America (GANA):
   8. Insulating Glass Certification Council (IGCC).
   9. Insulating Glass Manufacturers Alliance (IGMA):
   10. National Builders Hardware Association (NBHA):
      a. Recommended Location for Builders Hardware.
11. Building Code:
   a. International Code Council (ICC):
         amendments, referred to herein as Building Code.

B. Qualifications:
   1. Door and frame fabricator must have minimum 10 years experience in fabrication of flush
      aluminum doors and associated frames.
   2. Installation: Door and frame installation shall be performed by experienced workmen
      having a minimum five (5) years experience installing products similar to those specified.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at
      the Project site.
   2. Installer and applicator are synonymous.

B. PVDF: Polyvinylidene fluoride.

C. Safety Glazing: Glazing meeting the requirements of the Building Code and CPSC 16 CFR
   1201.

D. Other terms as identified in CSPC 16 CFR 1201.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Schedule of doors and frames using same reference numbers as indicated on Drawings.
   4. Certifications:
      a. Certification of manufacturer qualifications.
      b. Certification of installer qualifications.
      c. Certification that insulated glass units meet requirements of IGCC and are certified by
         IGCC to ASTM E2190.
   5. Warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store doors and frames in a dry, weather protected area.
   1. Place units on wood skids providing a minimum 6 IN air space above the ground.
   2. Do not store units flat, set frames and doors on edge providing minimum 1/2 IN air
      circulation space between each unit.
   3. Provide covering which will ensure air flow around each unit to prevent trapping of
      moisture.
   4. If door wrapper becomes wet immediately remove and provide dry protection equivalent to
      wrapper removed.

B. Where storage recommendations by unit manufacturer conflict with the above requirements, the
   more stringent requirement shall apply.

1.6 WARRANTY

A. Factory applied high performance organic coatings utilizing PVDF resins shall be provided with
   manufacturer's standard 20-year warranty against color fade, chalking and film integrity.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Aluminum doors and frames:
      a. Alutech Corp.
      b. Commercial Door Systems.
      c. Special-Lite, Inc.
   2. Insulated Low E glass units:
      a. Libbey-Owens-Ford.
      b. PPG.
      c. Viracon.
      d. Visteon.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. Aluminum:
   1. Extrusions: ASTM B221, 6063T5.

B. Stainless Steel:
   1. ASTM A240.
   2. Type 316.

C. FRP Sheet: Fiberglass Reinforced Plastic.

D. Insulation:
   1. Closed cell urethane.
      a. CFC and HCFC free.
      b. Ozone depletion potential: 0.
      c. Density: Minimum 5.0 pcf.

E. Fasteners: Stainless steel, Type 316.

2.3 ACCESSORIES

A. Lights (Glass Panels):
   1. Fixed, integral stops on exterior face.
   2. Screwless snap-in stops or stops secured with countersunk Phillips head machine screws on interior face.
   3. Insulating Glass Units:
      a. ASTM E2190, Class A.
      b. Provide units meeting requirements of CPSC 16 CFR 1201.
      c. Two (2) sheets of 1/4 IN thick tempered glass separated by a 1/2 IN dehydrated air space hermetically sealed.
         1) Tempered Float Glass:
            a) 1/4 IN thick.
            b) ASTM C1048, Kind FT, Condition A, Type 1.
            c) ANSI Z97.1.
            d) Outside lite: Bronze.
               (1) Low-E coating applied to second face.
               e) Inside Lite: Clear.
         2) Stainless Steel "warm-edge" spacer.
         3) Viracon "VE4-85":
            a) Visible light transmittance: 45 percent.
            b) Visible light reflectance outside: 7 percent.
c) Solar energy transmittance: 11 percent.
d) $U$ value summer/winter: $0.29/0.31\text{BTU/(HR x SF x DegF)}$.  
e) Shading coefficient: 0.43.  
f) Relative heat gain: 89 Btu/(HR x SF).  
g) Solar Heat Gain Coefficient (SHGC): 0.37. 

d. Provide polysulfide-based glazing sealants as necessary to resist exposure to sodium hypochlorite fluid or fumes.

2.4 FABRICATION

A. General:
1. Fabricate rigid, neat in appearance and free from defects.
2. Form to indicated sizes and profiles.
3. Fit and assemble in shop wherever practical.
4. Mark work that cannot be fully assembled in shop to assure proper assembly at site.
5. Factory prepare for finish hardware, in accordance with hardware schedule, templates provided by hardware supplier, DHI/ANSI A115.1, and NBHA.
   a. Locate hardware in accordance with "Recommended Location for Builders Hardware," by NBHA.
   b. See Specification Section 08700 for hardware.
6. Conceal fastenings wherever practical.
   a. Exposed fasteners to be countersunk Phillips or Jackson flat head screws and bolts.

B. Doors:
1. Nominal 1-3/4 IN thick.
2. Face: FRP sheet.
   a. Thickness: 0.125 IN.
   b. Texture: Sandstone.
3. Core:
   a. Insulated.
   b. Minimum R 5.8.
4. Hardware reinforcement:
   a. Aluminum or stainless steel.
   b. Reinforce hinges using continuous bar in hinge stile, tapped for hinges.
   c. Reinforce for hardware using plate screwed to tubular frame.
5. Size: 3 FT 0 IN by 7 FT 2 IN.

C. Frames:
1. Tubular design.
   a. Minimum thickness: 0.120 IN.
   b. Site-line:
      1) Minimum: 1-3/4 IN.
      2) Maximum: 2-1/4 IN.
   c. Depth: 6 IN.
2. Frames to be vertically reinforced at jambs.
   a. Reinforce for hinge using bar in hinge side of frame, tapped for hinges.
   b. Reinforce for all other hardware using plate screwed to frame.
   c. Reinforcement sizes shall be determined by the frame manufacturer.
   1) Minimum thickness: 1/4 IN.
   d. Wood blocking is not acceptable.
3. Stops:
   a. Screw applied.
   b. Weatherstripping: Manufacturer's standard resilient bulb weatherstripping.

D. Finish:
   a. Factory applied high performance organic coating with minimum 70 percent PVDF resin content.
b. Color: Dark Bronze.
2. FRP Facing: Dark Bronze.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions.
   1. Plumb, align, and brace securely until permanently anchored.
      a. Number and location of anchors shall be in accordance with frame manufacturer's recommendation with minimum of three (3) anchors per jamb.

B. Install insulated glass units in accordance with recommendations of manufacturer, GANA Glazing Manual and IGMA TM-3000.

C. Provide dissimilar materials protection.
   1. See Specification Section 09905.

D. Hardware: See Specification Section 08700.

E. Seal perimeter of door frame.
   1. See Specification Section 07900.

3.2 FIELD QUALITY CONTROL

A. Repair all damaged finishes or replace framing member or door as directed by Engineer.
   1. Use only materials and finishes as recommended or furnished by door and frame manufacturer.
   2. Final repaired finish shall match surrounding original finish or item being repaired shall be replaced with new item.

3.3 CLEANING

A. Clean doors and frames as recommended by manufacturer prior to acceptance by Owner.

3.4 PROTECTION

A. Protect doors and frames during construction.

END OF SECTION
SECTION 08700
FINISH HARDWARE

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Finish hardware.
   2. Inspection and testing of door operation.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 08120 - Aluminum Doors and Frames.

1.2 QUALITY ASSURANCE
A. All door hardware shall be provided by a single hardware supplier.
B. Referenced Standards:
   1. Americans with Disabilities Act (ADA):
      a. A156.1, Butts and Hinges.
      b. A156.3, Exit Devices.
      c. A156.4, Door Controls -Closers.
      d. A156.6, Architectural Door Trim.
      e. A156.8, Door Controls - Overhead Stops and Holders.
      f. A156.16, Auxiliary Hardware.
      g. A156.18, Materials and Finishes.
      h. A156.21, Thresholds.
   3. Door and Hardware Institute (DHI).
   5. Steel Door Institute (SDI).
   6. Building Code:
      a. International Code Council (ICC):
C. Qualifications:
   1. Installation shall be inspected by a certified Architectural Hardware Consultant (AHC).

1.3 DEFINITIONS
A. AHC: Architectural Hardware Consultant, certified by DHI.
B. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.
C. All weather: Capable of operation from -50 to +120 DegF.
1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Qualifications
      a. AHC qualifications and certification.
      b. No submittals will be reviewed until Engineer has received AHC certification.
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   4. Technical data sheets on each hardware item proposed for use.
   5. Certification from AHC stating all door hardware has been reviewed by AHC and verified
      to be compatible with doors and frames.
   6. Warranty information for all hardware devices having extended warranties.

B. Informational Submittals:
   1. Certifications:
      a. Certification from AHC stating all door hardware has been provided per approved Shop
         Drawings, has been installed in accordance with manufacturer's recommended
         installation instructions and all doors have been inspected and tested and found to be in
         proper working order.
         1) Door assemblies required to swing in the direction of egress have been inspected
            and tested in accordance with NFPA 101.

1.5 WARRANTY

A. Provide all individual manufacturers' extended warranties as advertised.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are
   acceptable:
   1. Closers:
      a. LCN.
      b. Norton.
      c. Corbin/Russwin.
   2. Hinges:
      a. Stanley Works.
      b. Hager Hinge Co.
      c. McKinney Manufacturing Co.
   3. Overhead stops:
      b. Rockwood.
      c. Trimco
      d. Rixson.
   4. Weatherstripping and thresholds:
      a. Pemko Manufacturing Co.
      b. Reese Enterprises, Inc.
      c. Zero Weatherstripping, Inc.
      d. National Guard Products, Inc.
   5. Exit devices:
      a. Von Duprin, Inc.
      b. Corbin/Russwin.
      c. Precision.
      d. Sargent.
6. Other materials: As noted.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. General: As indicated in the FABRICATION Article in PART 2 of this Specification Section.

B. Fasteners: Stainless steel or aluminum.

C. Closers:
   1. Corrosion resistant closer:
      b. All other components and fasteners: Stainless steel.
      c. Closer arm bushing: Bronze.

D. Kickplates: Stainless steel.

E. Thresholds: Aluminum.

F. Overhead Stops and Wall Stops: Stainless steel or aluminum.

G. Keys: Brass or bronze.

2.3 ACCESSORIES

A. Strikes:
   1. Curved lips.
      a. Extended lips when required.
   2. Appropriate for function and hardware listed.

2.4 FABRICATION

A. Hardware - General:
   1. Generally prepare for Phillips head machine screw installation.
   2. Exposed screws to match hardware finish or, if exposed in surfaces of other work, to match
      finish of other work as closely as possible.
   3. Provide concealed fasteners unless thru bolted.
   4. Through bolt closers on all doors.
   5. Furnish items of hardware for proper door swing.
   6. Furnish lock devices which allow door to be opened from inside room without a key or any
      special knowledge.

B. Hardware:
   1. Provide following ANSI/BHMA A156.18 finishes:
      b. Exit devices and strikes: 630 or 626.
      c. Butt hinges: 630.
      d. Door overhead stops: 630.
      e. Corrosion resistant closers: 630.

C. Door Closers:
   1. ANSI/BHMA A156.4, Grade 1.
   2. Size door closer to comply with ANSI recommendations for door size and location.
   3. Fabricate with integral back check.
   4. Provide all weather fluid.
   5. Full cover.
      a. Manufacturer's standard plastic cover.
   6. Arms, brackets, and plates: As required for complete installation.
      a. Provide manufacturer's standard 10 year warranty.
D. Hinges:
   1. Butt hinges:
      a. ANSI/BHMA A156.1.
         1) A5111: Stainless steel, full-mortise, anti-friction bearing, Grade 1.
      b. Ball bearing.
      c. Flat button tips.
         1) Non-removable pin (NRP).
   d. Butt hinges:
      1) Hager BB1199.
      2) McKinney T4B3386.
   e. Hinge size: 4.5 IN x 4.5 IN.

E. Overhead Door Holders/Stop:
   1. ANSI/BHMA A156.8.
   2. Provide 'hold-open' function.
   3. Surface mounted stops: Rockwood N14400 Series or Glynn Johnson 90 Series.
   4. Concealed stops: Rockwood N11000 Series or Glynn Johnson 100 Series.

F. Kickplates:
   1. ANSI/BHMA A156.6.
   2. 8 IN high x 2 IN less than door width.
   3. Beveled on all edges.
   4. Thickness:
      a. Stainless steel: 0.050 IN.

G. Thresholds:
   1. ANSI/BHMA A156.21.
   2. Thermally broken unit.
   3. Height: 1/2 IN high maximum.
   4. Width: 6 IN.

H. Exit Devices:
   1. ANSI/BHMA A156.3, Grade 1.
      a. Function: 03 - Night Latch.

I. Weatherstripping:
   1. Weather seal at jambs and head: See Specification Section 08120
   2. Sweep at bottom of doors: Reese 701.
      a. Color: Dark bronze anodized.

J. Keying:
   1. Establish keying with Owner.
      a. Provide two (2) keys for each lock or cylinder.
      b. Key to existing master key system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's installation instructions, supervised or inspected by an AHC.

B. Provide all hardware in accordance with Building Code.

C. Use SDI mounting heights for hardware.

D. Closers:
   1. Mount closers on push side of doors.

E. Overhead Stops:
   1. Provide overhead stop when corrosion resistant closer is specified.
F. Provide door sweep and threshold at all exterior doors.
   1. Set thresholds in a full bed of sealant.
   2. Mount door sweeps on exterior face of door.

G. Mount kickplates on push side of doors.

3.2 FIELD QUALITY CONTROL

A. Adjust and check each operating item of hardware to assure proper operation or function.
   1. Lubricate moving parts with lubricant recommended by manufacturer.

B. During week prior to startup, make a final check and adjustment of all hardware items.
   1. Clean and lubricate as necessary to assure proper function and operation.
   2. Adjust door control devices to compensate for operation of heating and ventilating equipment.

C. Inspection and Testing:
   1. AHC shall inspect and test all door assemblies and provide written certification that door assemblies are in proper working order.
      a. Door assemblies required to swing in the direction of egress shall be inspected and tested in accordance with NFPA 101.
   2. Submit documentation and certification of testing in accordance with the certifications paragraph in the SUBMITTALS Article in PART 1 of this Specification Section.

3.3 SCHEDULES

A. Hardware Schedule:
   1-1/2 PR Butt Hinges
   Mortise Exit Device Function 03
   Corrosion Resistant Closer
   Overhead Stop
   Kickplate
   Threshold
   Sweep

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. High performance industrial coatings (HPIC).
   2. Any other coating, thinner, accelerator, inhibitor, etc., specified or required as part of a complete System specified in this Specification Section.
   3. Minimum surface preparation requirements.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 03348 - Concrete Finishing and Repair of Surface Defects.
   4. Section 04220 - Concrete Masonry.
   5. Section 05505 - Metal Fabrications.
   6. Section 10400 - Identification Devices.
   7. Section 11005 - Equipment: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
      b. D4259, Standard Practice for Abrading Concrete.
      c. D4261, Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating.
      d. D4262, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces.
      e. D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
      f. D4414, Standard Practice for Measurement of Wet Film Thickness by Notch Gages.
   2. National Association of Pipe Fabricators (NAPF):
      a. 500-03, Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings:
         1) 500-03-04, Abrasive Blast Cleaning for Ductile Iron Pipe.
         2) 500-03-05, Abrasive Blast Cleaning for Cast Ductile Iron Fittings.
      a. Certified Coating Thickness Calibration Standards.
   4. The Society for Protective Coatings (SSPC):
      a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
      b. SP 1, Solvent Cleaning.
      c. SP 2, Hand Tool Cleaning.
      d. SP 3, Power Tool Cleaning.
      e. SP 16, Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.
   5. The Society for Protective Coatings/NACE International (SSPC/NACE):
      a. SP 5/NACE No. 1, White Metal Blast Cleaning.
      b. SP 6/NACE No. 3, Commercial Blast Cleaning.
      c. SP 7/NACE No. 4, Brush-off Blast Cleaning.
      d. SP 10/NACE No. 2, Near-White Blast Cleaning.
B. Qualifications:
1. Coating manufacturer's authorized representative shall provide written statement attesting that applicator has been instructed on proper preparation, mixing and application procedures for coatings specified.
2. Applicators shall have minimum of 10 years experience in application of similar products on similar project.
   a. Provide references for minimum of three (3) different projects completed in last five (5) years with similar scope of work.
   b. Include name and address of project, size of project in value (painting) and contact person.

C. Miscellaneous:
1. Furnish paint through one (1) manufacturer unless noted otherwise.

D. Deviation from specified mil thickness or product type is not allowed without written authorization of Engineer.

E. Material shall not be thinned unless approved, in writing, by paint manufacturer's authorized representative.

1.3 DEFINITIONS

A. Installer or Applicator:
1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

B. Approved Factory Finish: Finish on a product in compliance with the finish specified in the Specification Section where the product is specified or in Specification Section 11005.

C. Corrosive Environment: Immersion in, or not more than 6 IN above, or subject to condensation, spillage or splash of a corrosive material such as water, wastewater, or chemical solution; or exposure to corrosive, caustic or acidic agent, chemicals, chemical fumes, chemical mixture, or solutions with pH range of 5 to 9.
   1. For purposes of this Specification Section, the entire area is considered a corrosive environment.

D. Exposed Exterior Surface:
1. Surface which is exposed to weather but not necessarily exposed to view as well as surface exposed to view.
2. Exterior surfaces are considered corrosive environment.

E. Finished Area: An area that is listed in or has finish called for on Room Finish Schedule or is indicated on Drawings to be painted.

F. Immersion Surface:
1. Any surface immersed in water or some other liquid.
2. Surface of any pipe, valve, or any other component of the piping system subject to condensation.

G. HPIC: High performance industrial coatings.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Applicator experience qualifications.
   a. No submittal information will be reviewed until Engineer has received and approved
      applicator qualifications.

3. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's application instructions.
   c. Manufacturer's surface preparation instructions.
   d. If products being used are manufactured by Company other than listed in the
      MATERIALS Article of this Specification Section, provide complete individual data
      sheet comparison of proposed products with specified products including application
      procedure, coverage rates and verification that product is designed for intended use.

4. Certification that High Performance Coating Systems proposed for use have been reviewed
   and approved by Senior Corrosion Specification Specialist employed by the coating
   manufacturer.

B. Informational Submittals:
1. See Specification Section 01340 for requirements for the mechanics and administration of
   the submittal process.
2. Contractor's written plan of action for containing airborne particles created by blasting
   operation and location of disposal of spent contaminated blasting media.
3. Coating manufacturer's recommendation on abrasive blasting.
4. Manufacturer's recommendation for universal barrier coat.
5. Manufacturer's recommendation for providing temporary or supplemental heat or
   dehumidification or other environmental control measures.
7. Manufacturer's approval of application equipment.
8. Applicator's daily records:
   a. Submit daily records at end of each week in which painting work is performed unless
      requested otherwise by Engineer's on-site representative.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver in original containers, labeled as follows:
1. Name or type number of material.
2. Manufacturer's name and item stock number.
3. Contents, by volume, of major constituents.
4. Warning labels.
5. VOC content.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, only the following manufacturers are
   acceptable:
1. High performance industrial coatings:
   a. Tnemec.
   b. Carboline Protective Coatings.
   c. Sherwin Williams.
   d. PPG Industries.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. For unspecified materials such as thinner, provide manufacturer's recommended products.
B. Paint Systems - General:
1. $P =$ prime coat.
2. $F_1, F_2, \ldots, F_n =$ first finish coat, second finish coat, \ldots, $n$th finish coat, color as selected by Engineer.
3. If two (2) finish coats of same material are required, Contractor may, at his option and by written approval from paint manufacturer, apply one (1) coat equal to mil thickness of two (2) coats specified.

C. HPIC products listed in the MATERIALS Article, Paint Systems paragraph are manufactured by Tnemec.
1. Products of other listed manufacturers are acceptable for use providing the product is of the same generic resin, requires comparable surface preparation, has comparable application requirements, meets the same VOC levels or better, provides the same finish and color options and will withstand the atmospheric conditions of the location where it is to be applied.

D. Paint Systems (Systems not shown are not used):
1. HPIC SYSTEM #1 - Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Finish Coat(s).
   a. Prime coat:
      1) $P_1 =$ 1 coat, 3 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
   b. Finish coat(s):
      1) Interior:
         a) $F_1 =$ 1 coat, 3 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
         b) $F_2 =$ 1 coat, 3 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
      2) Exterior:
         a) $F_1 =$ 1 coat, 3 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
         b) $F_2 =$ 1 coat, 2.5 mils, Series 1080 Endura-Shield. W.B. (Waterborne Acrylic Polyurethane).

2. HPIC SYSTEM #2 - Zinc-Rich Urethane Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Finish Coat(s).
   a. Prime coat:
      1) $P_1 =$ 1 coat, 3.5 mils, Series 90-97 Tneme-Zinc (Zinc-Rich Urethane).
   b. Finish coat(s):
      1) Interior:
         a) $F_1 =$ 1 coat, 6 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
      2) Exterior:
         a) $F_1 =$ 1 coat, 6 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
         b) $F_2 =$ 1 coat, 2.5 mils, Series 1080 Endura-Shield W.B. (Waterborne Acrylic Polyurethane).

3. HPIC SYSTEM #3 - Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Top Coat(s).
   a. Prime coat:
      1) $P_1 =$ 1 coat, 5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
   b. Finish coat(s):
      1) Interior:
         a) $F_1 =$ 1 coat, 5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
      2) Exterior:
         a) $F_1 =$ 1 coat, 2.5 mils, Series 1080 Endura-Shield W.B. (Waterborne Acrylic Polyurethane).

4. HPIC SYSTEM #4 - Zinc-Rich Urethane Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Top Coat(s).
   a. Prime coat:
      1) $P_1 =$ 1 coat, 2.5 mils, Series 90-97 Tneme-Zinc (Zinc-Rich Urethane).
b. Finish coat(s):
   1) Interior:
      a) F1 = 1 coat, 3 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
   2) Exterior:
      a) F1 = 1 coat, 2.5 mils, Series 1080 Endura-Shield W.B. (Waterborne Acrylic Polyurethane).

5. HPIC SYSTEM #5 - Modified Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Top Coat(s).
   a. Prime coat:
      1) P1 = 1 coat, 2.0 mils, Series 135 Chembuild (Modified Polyamidoamine Epoxy).
   b. Finish coat(s):
      1) Interior:
         a) F1 = 1 coat, 2.5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
      2) Exterior:
         a) F1 = 1 coat, 2.0 mils, Series 1080 Endura-Shield W.B. (Waterborne Acrylic Polyurethane).

6. HPIC SYSTEM #7 - Zinc-Rich Urethane Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Top Coat(s).
   a. Prime coat:
      1) P1 = 1 coat, 2.5 mils, Series 90-97 Tneme-Zinc (Zinc-Rich Urethane).
   b. Finish coat(s):
      1) Interior:
         a) F1 = 1 coat, 5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
      2) Exterior:
         a) F1 = 1 coat, 3.0 mils, Series 1080 Endura-Shield W.B. (Waterborne Acrylic Polyurethane).

7. HPIC SYSTEM #16 - Polyamidoamine Epoxy Prime and Top Coat(s).
   a. Prime coat:
      1) P1 = 1 coat, 75 to 100 SF/GAL/coat, Series L69 Epoxoline (Polyamidoamine Epoxy).
   b. Finish coat(s):
      1) Interior:
         a) F1 = 1 coat, 75-100 SF/GAL/coat, Series L69 Epoxoline (Polyamidoamine Epoxy).

8. HPIC SYSTEM #19 - Polyamidoamine Epoxy Coating.
   a. Prime coat:
      1) P1 = 1 coat, 5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).

9. HPIC SYSTEM #26 - Polyamidoamine Epoxy Primer with Modified Polyurethane Top Coat.
   a. Filler-surfacer:  1 coat, 1/16 IN to 1/8 IN Series 218 MortarClad as necessary to fill voids and surface defects and provide smooth substrate free of pinholes.
   b. Prime coat:
      1) P1 = 1 coat, 4 to 6 mils, Series N69 Epoxoline II (Polyamidoamine Epoxy).
   c. Cracks and joint repairs: Series 265 in accordance with Tnemec ElastoShield Construction Details.
   d. Finish coat(s):
      1) Interior or exterior:
         a) F1 = 1 coat, 50 to 60 mils, Series 262 Elasto-Shield (Modified Polyurethane).
         b) F2 = 1 coat, 50 to 60 mils, Series 262 Elasto-Shield (Modified Polyurethane).

10. HPIC SYSTEM #31 - Polyamidoamine Epoxy Primer and Intermediate Coat with Waterborne Polyester Polyurethane Top Coat with Glass Beads mixed in for slip resistance.
    a. Prime coat:
       1) P1 = 4 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
    b. Finish coats:
       1) F1 = 4 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
2) \(F_2 = 3\) mils minimum (thickness as required to cover glass beads), Series 291 CRU (Waterborne Polyester Polyurethane).

c. Slip resistance:
   1) Blend coarse glass beads into first finish coat (F1) at rate required to provide a medium slip resistant texture.
      a) Refer to accepted mock-up panel.
   2) Apply second finish coat (F2) at minimum 3 mil DFT.
      a) Apply additional coats of F2 product as required to achieve the non-slip texture per the accepted mock-up panel.

d. Glass beads: TNEMEC Product #211-212 Coarse Glass Beads.

**PART 3 - EXECUTION**

3.1 ITEMS TO BE PAINTED

A. General:
   1. Paint the following surfaces in a corrosive area, whether exposed to view or not:
      a. Concrete and/or concrete masonry units.
      b. Conduit.
      c. Galvanized metal surfaces.

B. Exposed Exterior Surfaces including:
   1. Piping, valves, fittings, and hydrants and supports.
   2. Miscellaneous ferrous metal surfaces.
   3. Steel lintels.
   4. Steel components of concrete lintels.
      a) Steel components shall be completely painted (with both prime and finish coats) prior to installing in the wall.

C. Interior Areas:
   1. Paint all appurtenant surfaces within the space unless specifically noted not to be painted in the Contract Documents.
      a. Appurtenant surfaces include:
         1) Concrete columns, equipment pads, pipe supports, and equipment supports, underside of overhead concrete slabs which are exposed, semi-exposed or concealed from view but still exposed to the adjacent atmosphere.
         2) Piping, valves, fittings, hydrants and supports.
         3) Conduit, device boxes, junction boxes, pull boxes, covers and supports when mounted on surface required to be painted.
         4) Miscellaneous ferrous metal surfaces.
         5) Steel components of concrete lintels.
            a) Steel components shall be completely painted (with both prime and finish coats) prior to installing in the wall.

3.2 ITEMS NOT TO BE PAINTED

A. General: Do not paint items listed in this Article unless specifically noted in the Contract Documents to be painted.

B. Items with Approved Factory Finish: These items may require repair of damaged painted areas or painting of welded connections.

C. Electrical Equipment:
   1. Do not field paint electrical equipment except where painting is specifically stated elsewhere in these Contract Documents, or where the equipment is subject to a corrosive environment and is specifically noted to be painted.
D. Other Items:
   1. Stainless steel surfaces except:
      a. Piping where specifically noted to be painted.
      b. Banding as required to identify piping.
   2. Aluminum surfaces except:
      a. Where specifically shown in the Contract Documents.
      b. Where in contact with concrete.
      c. Where in contact with dissimilar metals.
   3. Fiberglass surfaces except:
      a. Fiberglass piping where specifically noted to be painted.
      b. Piping supports where specifically noted to be painted.
   4. Interior of pipe, ductwork, and conduits.
   5. Moving parts of mechanical and electrical units where painting would interfere with the
      operation of the unit.
   7. Precolored masonry.
   8. Prefinished metal.
   9. Contact surfaces of friction-type connections.

3.3 SCHEDULE OF ITEMS TO BE PAINTED AND PAINTING SYSTEMS

A. Concrete:
      a. Includes equipment bases, pads, walls, beams, slabs, columns, pedestals, pilasters, etc.

B. Concrete Masonry Units: SYSTEM #16.

C. Ferrous metals subject to corrosive environment: SYSTEM #2.

D. Galvanized Metals: SYSTEM #3.

E. Steel equipment with existing paint coating or factory-applied prime or finish coating not
   complying with this Specification Section: SYSTEM #5.
   1. Includes equipment specifically indicated in the Contract Documents to be painted.
   2. Factory-applied coats to remain.

F. Non-ferrous metals: SYSTEM #3.

G. Electrical Conduit: SYSTEM #3.

H. Pipe, Valves, and Fittings:
   1. Steel: SYSTEM #2.
   2. Ductile iron: SYSTEM #3.
   3. Cast-iron: SYSTEM #5

I. Aluminum in contact with concrete, between dissimilar metals and dissimilar materials:
   SYSTEM #19.

3.4 PREPARATION

A. General:
   1. Verify that atmosphere in area where painting is to take place is within paint manufacturer's
      acceptable temperature, humidity and sun exposure limits.
      a. Provide temporary heating, shade and/or dehumidification as required to bring area
         within acceptable limits.
         1) Provide temporary dehumidification equipment properly sized to maintain
            humidity levels required by paint manufacturer.
         2) Provide clean heat with heat exchanger type equipment sufficient in size to
            maintain temperature on a 24 HR basis.
            a) Vent exhaust gases to exterior environment.
b) No exhaust gases shall be allowed to vent into the space being painted or any adjacent space.

2. Prepare surfaces to be painted in accordance with coating manufacturer's instructions and this Specification Section unless noted otherwise in this Specification Section.
   a. Where discrepancy between coating manufacturer's instructions and this Specification Section exists, the more stringent preparation shall be provided unless approved otherwise, in writing, by the Engineer.

3. Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of coating to surface.

4. Adhere to manufacturer's recoat time surface preparation requirements.
   a. Surfaces that have exceeded coating manufacturer's published recoat time and/or have exhibited surface chalking shall be prepared prior to additional coating in accordance with manufacturer's published recommendations.

   1) Minimum SSPC SP 7/NACE No. 4 unless otherwise approved by Engineer.

B. Protection:
   1. Protect surrounding surfaces not to be coated.
   2. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.

C. Prepare and paint before assembly all surfaces which are inaccessible after assembly.

D. Ferrous Metal:
   1. Prepare ductile iron pipe in accordance with pipe manufacturer's recommendations and NAPF.
      a. All piping, pumps, valves, fittings and any other component used in any water piping system that requires preparation for painting shall be prepared in accordance with requirements for immersion service.
      1) Pipe: NAPF 500-03-04.
      2) Fittings: NAPF 500-03-05.
      b. Prepare all areas requiring patch painting in accordance with recommendations of manufacturer and NAPF.
      c. Remove bituminous coating per piping manufacturer, paint manufacturer and NAPF recommendations.

      1) The most stringent recommendations shall apply.
   2. Complete fabrication, welding or burning before beginning surface preparation.
      a. Chip or grind off flux, spatter, slag or other laminations left from welding.
      b. Remove mill scale.
      c. Grind smooth rough welds and other sharp projections.
   3. Solvent clean in accordance with SSPC SP 1 all surfaces scheduled to receive additional SSPC surface preparation.
   4. Surfaces subject to corrosive environment and all surfaces subject to immersion service:
      a. Near-white blast clean in accordance with SSPC SP 10/NACE No. 2.
   5. Restore surface of field welds and adjacent areas to original surface preparation.
   6. Black iron piping: Remove surface varnish by solvent cleaning or brush-off blast cleaning in accordance with SSPC SP 7/NACE No. 4.

E. Galvanized Steel and Non-ferrous Metals:
   1. Solvent clean in accordance with SSPC SP 1 followed by brush-off blast clean in accordance with SSPC SP 16 to remove zinc oxide and other foreign contaminants.
      a. Provide uniform 1 mil profile surface.

F. Abrasive blast clean the following equipment or surfaces regardless of previous finish, if any.

G. Concrete:
   1. Cure for minimum of 28 days.
2. Verify that concrete surfaces have been cleaned and that voids have been patched in accordance with Specification Section 03348.
   a. Concrete surfaces shall be cleaned in accordance with ASTM D4258.
3. Mechanically abrade concrete surfaces in accordance with ASTM D4259 as recommended by coating manufacturer to remove fins and projections.
4. Abrasive blast concrete surfaces in accordance with SSPC SP 13/NACE No. 6 to provide profile recommended by coatings manufacturer.
5. Test pH of surface to be painted in accordance with ASTM D4262.
   a. If surface pH is not within coating manufacturer's required acceptable range, use methods acceptable to coating manufacturer as required to bring pH within acceptable range.
   b. Retest pH until acceptable results are obtained.
6. Verify that moisture content of surface to be painted is within coating manufacturer's recommended acceptable limits.
   a. Test moisture content of surface to be coated in accordance with ASTM D4263.
   b. After remedial measures have been taken to lower or raise moisture content, retest surface until acceptable results are obtained.

H. Concrete Unit Masonry:
1. Cure for minimum of 28 days.
2. Remove all mortar spatters and protrusions.
3. Verify that concrete unit masonry surfaces have been cleaned in accordance with Specification Section 04220 and ASTM D4261.
4. Test pH of surface to be painted in accordance with ASTM D4262.
   a. If surface pH is not within coating manufacturer's required acceptable range, use methods acceptable to coating manufacturer as required to bring pH within acceptable limits.
   b. Retest pH until acceptable results are obtained.
5. Verify that moisture content of surface to be painted is within coating manufacturer's recommended acceptable limits.
   a. Test moisture content of surface to be coated in accordance with ASTM D4263.
   b. After remedial measures have been taken to lower or raise moisture content, retest surface until acceptable range is obtained.

I. Preparation by Abrasive Blasting:
1. All abrasive-blasted ferrous metal surfaces shall be inspected immediately prior to application of paint coatings.
   a. Inspection shall be performed to determine cleanliness and profile depth of blasted surfaces and to certify that surface has been prepared in accordance with these Specifications.
2. Schedule the abrasive blasting operation so blasted surfaces will not be wet after blasting and before painting.
3. Perform additional blasting and cleaning as required to achieve surface preparation required.
   a. Prior to painting, reblast surfaces allowed to set overnight and surfaces that show rust bloom.
   b. Surfaces allowed to set overnight or surfaces which show rust bloom prior to painting shall be re-inspected prior to paint application.
4. Profile depth of blasted surface: Not less than 1 mil or greater than 2 mils unless required otherwise by coating manufacturer.
5. Provide compressed air for blasting that is free of water and oil.
   a. Provide accessible separators and traps.
6. Confine blast abrasives to area being blasted.
   a. Provide shields of polyethylene sheeting or other such barriers to confine blast material.
   b. Plug pipes, holes, or openings before blasting and keep plugged until blast operation is complete and residue is removed.
7. Protect nameplates, valve stems, rotating equipment, motors and other items that may be damaged from blasting.

8. Reblast surfaces not meeting requirements of these Specifications.

9. Abrasive blasting media may be recovered, cleaned and reused providing Contractor submits, for Engineer's review, a comprehensive recovery plan outlining all procedures and equipment proposed in reclamation process.

10. Properly dispose of blasting material contaminated with debris from blasting operation not scheduled to be reused.

J. Non-Ferrous Surfaces except Galvanized Steel:

1. Sand using 80-100 grit sandpaper to scarify surfaces.

3.5 APPLICATION

A. General:

1. Thin, mix and apply coatings by brush, roller, or spray in accordance with manufacturer's installation instructions.

   a. Application equipment must be inspected and approved in writing by coating manufacturer.

2. Temperature and weather conditions:

   a. Do not paint surfaces when surface temperature is below 50 DegF unless product has been formulated specifically for low temperature application and application is approved in writing by Engineer and paint manufacturer's authorized representative.

   b. Avoid painting surfaces exposed to hot sun.

   c. Do not paint on damp surfaces.

3. Provide complete coverage to mil thickness specified.

   a. Thickness specified is dry mil thickness.

   b. All paint systems are "to cover."

      1) In situations of discrepancy between manufacturer's square footage coverage rates and mil thickness, mil thickness requirements govern.

      c. When color or undercoats show through, apply additional coats until paint film is of uniform finish and color.

4. If so directed by Engineer, do not apply consecutive coats until Engineer has had an opportunity to observe and approve previous coats.

5. Apply materials under adequate illumination.

6. Evenly spread to provide full, smooth coverage.

7. Work each application of material into corners, crevices, joints, and other difficult to work areas.

8. Avoid degradation and contamination of blasted surfaces and avoid intercoat contamination.

   a. Clean contaminated surfaces before applying next coat.

9. Smooth out runs or sags immediately, or remove and recoat entire surface.

10. Allow preceding coats to dry before recoating.

    a. Reccoat within time limits specified by coating manufacturer.

    b. If recoat time limits have expired re-prepare surface in accordance with coating manufacturer's printed recommendations.

11. Allow coated surfaces to cure prior to allowing traffic or other work to proceed.

12. Coat all aluminum in contact with dissimilar materials.

13. When coating rough surfaces which cannot be backrolled sufficiently, hand brush coating to work into all recesses.

14. Backroll concrete and masonry surfaces with a roller if paint coatings are spray applied.

B. Prime Coat Application:

1. Prime all surfaces indicated to be painted.

   a. Apply prime coat in accordance with coating manufacturer's written instructions and as written in this Specification Section.

2. Ensure field-applied coatings are compatible with factory-applied coatings.

   a. Ensure new coatings applied over existing coatings are compatible.
b. Employ services of coating manufacturer's qualified technical representative.
   1) Certify through material data sheets.
   2) Perform test patch.

c. If field-applied coating is found to be not compatible, require the coating manufacturer's technical representative to recommend, in writing, product to be used as barrier coat, thickness to be applied, surface preparation and method of application.

d. At Contractor's option, coatings may be removed, surface re-prepared, and new coating applied using appropriate paint system listed in the MATERIALS Article, Paint Systems paragraph of this Specification Section.
   1) All damage to surface as result of coating removal shall be repaired to original condition or better by Contractor at no additional cost to Owner.

3. Prime ferrous metals embedded in concrete to minimum of 1 IN below exposed surfaces.
4. Apply zinc-rich primers while under continuous agitation.
5. Ensure abrasive blasting operation does not result in embedment of abrasive particles in paint film.
6. Brush or spray bolts, welds, edges and difficult access areas with primer prior to primer application over entire surface.
7. Touch up damaged primer coats prior to applying finish coats.
   a. Restore primed surface equal to surface before damage.
8. All surfaces of steel lintels and steel components of concrete lintels used in wall construction shall be completely painted with both prime and finish coats prior to placing in wall.

C. Finish Coat Application:
   1. Apply finish coats in accordance with coating manufacturer's written instructions and in accordance with this Specification Section.
      a. Where conflicts exist between this Specification Section and manufacturer's instructions, the more stringent requirement shall apply.
   2. Touch up damaged finish coats using same application method and same material specified for finish coat.
      a. Prepare damaged area in accordance with the PREPARATION Article of this Specification Section.

3.6 FIELD QUALITY CONTROL

A. Contractor to provide protection for surfaces painted with epoxy coatings to prevent chalking.
   1. Surfaces showing chalking will not be accepted.

B. Maintain Daily Records:
   1. Record the following information during application of each coat of paint applied:
      a. Date, starting time, end time, and all breaks taken by painters.
      b. For exterior painting:
         1) Sky condition.
         2) Wind speed and direction.
      c. Air temperature.
      d. Relative humidity.
      e. Moisture content and surface temperature of substrate prior to each coat.
      f. Provisions utilized to maintain work area within manufacturer's recommended application parameters including temporary heating, ventilation, cooling, dehumidification and provisions utilized to mitigate wind blown dust and debris from contaminating the wet paint film.
      g. Record environmental conditions, substrate moisture content and surface temperature information not less than once every four (4) HRS during application.
         1) Record hourly when temperatures are below 50 DegF or above 100 DegF.
   2. Record the following information daily for the paint manufacturer's recommended curing period:
      a. Date and start time of cure period for each item or area.
b. For exterior painting:
   1) Sky conditions.
   2) Wind speed and direction.

c. Record environmental conditions not less than once every 12 HRS.
   1) Record once every four (4) HRS when ambient temperature is below 35 DegF.

d. Provisions utilized to protect each item or area and to maintain areas within
   manufacturer's recommended curing parameters.

3. Format for daily record to be computer generated.

C. Measure wet coating with wet film thickness gages in accordance with ASTM D4414.

D. Measure coating dry film thickness in accordance with SSPC PA 2 using Mikrotest gage
   calibrated against NBS "Certified Coating Thickness Calibration Standards."
   1. Engineer may measure coating thickness at any time during project to assure conformance
      with these Specifications.

E. Measure surface temperature of items to be painted with surface temperature gage specifically
   designed for such.

F. Measure substrate humidity with humidity gage specifically designed for such.

G. Provide wet paint signs.

3.7 CLEANING

A. Clean paint spattered surfaces.
   1. Use care not to damage finished surfaces.

B. Upon completion of painting, replace hardware, accessories, plates, fixtures, and similar items.

C. Remove surplus materials, scaffolding, and debris.

END OF SECTION
SECTION 10200
LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Louvers.

B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 07600 - Flashing and Sheet Metal.
   4. Section 07900 - Joint Sealants.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Aluminum Association (AA):
   3. Air Movement and Control Association (AMCA).
   4. ASTM International (ASTM):

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Drawing showing location of each louver or vent, indicating size and arrangement of blank-off plates if required.
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.

B. Samples:
   1. Samples of factory applied high performance organic coatings of colors proposed for matching existing finishes.
   2. Provide actual metal samples (aluminum).
      a. Color cards and computer generated color reproductions are not acceptable.

C. Factory applied high performance organic coatings utilizing PVDF resins shall be provided with manufacturer's standard 20 year warranty against color fade, chalking and film integrity.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Louvers:
      a. Airolite Co.
      b. Construction Specialties, Inc.
      c. Ruskin Manufacturing.
      d. Industrial Louvers, Inc.
      e. American Warming.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MANUFACTURED UNITS

A. Louvers:
   1. 4 IN deep.
   2. Drainable with blades at 37-1/2 degrees.
   3. Continuous blade appearance.
   4. ASTM B221 extruded aluminum, alloy 6063T5, minimum 0.081 IN thick.
   5. Minimum free area: 8.58 SF for 4 x 4 FT louver.
   6. Maximum pressure drop: 0.10 IN of water at 700 fpm.
   7. Water penetration: 0.01 OZ/SF at 873 fpm.
   8. AMCA certified.
   9. Ruskin "ELF 375DX".
   10. Insect screen:
       a. 18-16 mesh aluminum.
       b. Install in standard aluminum frame.

B. Anchors, Fasteners, Reinforcing: Aluminum or stainless steel.

C. Finish:

D. Finish:
   1. Meet requirements of AAMA 2605.
      a. PVDF coating with minimum 70 percent resin content.
      b. Color: Dark Bronze to match existing.

E. Size: Refer to Mechanical Drawings for louver size, and refer to Architectural Drawings for louver shapes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchoring and bracing accessories as required.

C. Seal around perimeter on exterior and interior.
   1. See Section 07900.

D. Install pre-finished aluminum flashing to match louver.
   1. See Section 07600.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Tag, tape and stenciling systems for equipment, piping, valves, pumps, ductwork and similar items, and hazard and safety signs.

B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
1. American Society of Mechanical Engineers (ASME):
2. Instrumentation, Systems, and Automation Society (ISA).
   a. 70, National Electrical Code (NEC).
5. Occupational Safety and Health Administration (OSHA):

1.3 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
   a. Catalog information for all identification systems.
   b. Acknowledgement that products submitted meet requirements of standards referenced.
3. Identification register, listing all items in PART 3 of this Specification Section to be identified, type of identification system to be used, lettering, location and color.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. W.H. Brady Co.
2. Panduit.
5. Carlton Industries, Inc.
2.2 MANUFACTURED UNITS

A. Type B2 - Nonmetallic Signs:
   1. Materials: Fiberglass reinforced or durable plastic.
   2. Size:
      a. Surface: As required by text.
      b. Thickness: 60 mils minimum.
   3. Fabrication:
      a. Rounded corners.
      b. Drilled holes in corners with grommets.
      c. Legend: Preprinted, permanently embedded and fade resistant for a 10 year minimum outdoor durability.
   4. Color:
      a. Background: Manufacturer standard or as specified.
      b. Lettering: Black.

B. Type D - Self-Adhesive Tape Tags and Signs:
   1. Materials: Vinyl tape or vinyl cloth.
   2. Size:
      a. Surface: As required by text.
      b. Thickness: 5 mils minimum.
   3. Fabrication:
      a. Indoor/Outdoor grade.
      b. Weather and UV resistant inks.
      c. Permanent adhesive.
      d. Legend: Preprinted.
      e. Wire markers to be self-laminating.
   4. Color: White with black lettering or as specified.

C. Type E - Heat Shrinkable Tape Tags:
   2. Size: As required by text.
   3. Fabrication:

D. Type F - Underground Warning Tape:
   2. Size:
      a. 6 IN wide (minimum).
      b. Thickness: 3.5 mils.
   3. Fabrication:
      a. Legend: Preprinted and permanently imbedded.
      b. Message continuous printed.
      c. Tensile strength: 1750 psi.

E. Underground Tracer Wire:
   1. Materials:
      a. Wire:
         1) 12 GA AWG.
         2) Solid.
135-230216-003 Watertown WWTF
Alkalinity Feed Addition -
IDENTIFICATION DEVICES

2.3 ACCESSORIES
A. Fasteners:
   1. Bead chain: #6 brass, aluminum or stainless steel.
   2. Plastic strap: Nylon, urethane or polypropylene.

2.4 MAINTENANCE MATERIALS
A. Where stenciled markers are provided, clean and retain stencils after completion and include in extra stock, along with required stock of paints and applicators.

PART 3 - EXECUTION
3.1 GENERAL INSTALLATION
A. Install identification devices at specified locations.
B. All identification devices to be printed by mechanical process, hand printing is not acceptable.
C. Attach tags to equipment with sufficient surface or body area with solvent activated adhesive applied to back of each tag.
D. Attach tags with 1/8 IN round or flat head screws to equipment without sufficient surface or body area, or porous surfaces.
   1. Where attachment with screws should not or cannot penetrate substrate, attach with plastic strap.
E. Single items of equipment enclosed in a housing or compartment to be tagged on outside of housing.
   1. Several items of equipment mounted in housing to be individually tagged inside the compartment.
F. Tracer Wire:
   1. Provide for all non-metallic buried piping.
   2. Attach to pipe at a maximum of 10 FT intervals with tape or tie-wraps.
   3. If split bolts are used for splicing, wrap with electrical tape.
   4. If wire nuts are used for splicing, knot wire at each splice point leaving 6 IN of wire for splicing.

3.2 SCHEDULES
A. Process Systems:
   1. General:
      a. Provide arrows and markers on piping.
         1) At 10 FT maximum centers along continuous lines.
         2) At changes in direction (route) or obstructions.
         3) At valves, risers, "T" joints, machinery or equipment.
         4) Where pipes pass through floors, walls, ceilings, cladding assemblies and like obstructions provide markers on both sides.
      b. Position markers on both sides of pipe with arrow markers pointing in flow direction.
         1) If flow is in both directions use double headed arrow markers.
      c. Apply tapes and stenciling in uniform manner parallel to piping.
   2. Trenches with piping:
      a. Tag type: Type F - Underground Warning Tape
      b. Location: Halfway between top of piping and finished grade.
d. Natural gas:
   1) Color: Yellow with black letters.
   2) Legend:
      a) First line: “CAUTION CAUTION CAUTION”
      b) Second line: “BURIED GAS LINE BELOW”
e. Potable water:
   1) Color: Blue with black letters.
   2) Legend:
      a) First line: “CAUTION CAUTION CAUTION”
      b) Second line: “BURIED WATER LINE BELOW”
f. Nonpotable water and sump pump piping:
   1) Color: Green with black letters.
   2) Legend:
      a) First line: “CAUTION CAUTION CAUTION”
      b) Second line: “BURIED NONPOTABLE WATER LINE BELOW”
g. Chemical feed piping (sodium hydroxide solution, etc.):
   1) Color: Yellow with black letters.
   2) Legend:
      a) First line: “CAUTION CAUTION CAUTION”
      b) Second line: “BURIED CHEMICAL LINE BELOW”
h. Other piping (e.g., compressed air, irrigation, refrigerant, heating water, etc.):
   1) Color: Yellow with black letters.
   2) Legend:
      a) First line: “CAUTION CAUTION CAUTION”
      b) Second line: “BURIED PIPE LINE BELOW”

3. Process equipment (e.g., pumps, etc.):
   a. Tag type:
      1) Type B2 - Nonmetallic Signs.
   b. Fastener:
      1) Adhesive.
   c. Legend:
      1) Letter height: 1/2 IN minimum.
      2) Equipment designation as indicated on the Drawings (e.g., “Sodium Hydroxide Feed Pump SHFP-01”).
4. Piping systems:
   a. Tag type:
      1) Indoor locations:
         a) Type D - Self-Adhesive Tape Tags and Signs.
   b. Fastener: Self.
   d. Legend:
      1) Letter height: Manufacturers standard for the pipe diameter.
      2) Mark piping in accordance with ASME A13.1.
      3) Use piping designation as indicated on the Drawings.
      4) Arrow: Single arrow.
   e. Spacing: Provide label spacing every 10 FT.
5. Process tanks (over 1000 GAL) and basins, (e.g., chemical storage, etc):
   a. Tag type:
      1) Type D – Self-Adhesive Signs.
   b. Fastener:
      1) Self.
   c. Location as directed by Owner.
   d. Legend:
      1) Letter height: 4 IN minimum.
2) Equipment designation as indicated on the Drawings (e.g., “Sodium Hydroxide Storage Tank”).

B. HVAC Systems:
1. General:
   a. Provide arrows and markers on ducts.
      1) At 20 FT maximum centers along continuous lines.
      2) At changes in direction (route) or obstructions.
      3) At dampers, risers, branches, machinery or equipment.
      4) Where ducts pass through floors, walls, ceilings, cladding assemblies and like obstructions provide markers on both sides.
   b. Position markers on both sides of duct with arrow markers pointing in flow direction.
      1) If flow is in both directions use double headed arrow markers.
   c. Apply tapes and stenciling in uniform manner parallel to ducts.
2. HVAC Equipment (e.g., unit heaters, exhaust fans, air handlers, etc.):
   a. Tag type:
      1) Type B2 - Nonmetallic Signs.
      2) Type C - Phenolic Name Plates.
   b. Fastener: Screws.
   c. Legend:
      1) Letter height: 1 IN minimum.
      2) Equipment designation as indicated on the Drawings (e.g., "EF-xxx").
3. Ductwork:
   a. Tag type:
      1) Type D - Self-Adhesive Tape Tags and Signs.
      2) Type G - Stenciling System.
   b. Fastener: Self.
   c. Legend:
      1) Letter height: 1 IN minimum.
      2) Description of ductwork, (e.g., “AIR SUPPLY”).
      3) Arrows: Single arrow.
4. Enclosure for instrumentation and control equipment, (e.g., fan control panels, etc.):
   a. Tag type: Type C - Phenolic Name Plates.
   b. Fastener: Screws.
   c. Legend:
      1) Letter height: 1/2 IN minimum.
      2) Equipment designation as indicated on the Drawings (e.g., "FAN CONTROL PANEL FCP-xxx").
5. Wall mounted thermostats:
   a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
   b. Fastener: Self.
   c. Legend:
      1) Letter height: 3/16 IN minimum.
      2) Description of equipment controlled (e.g., "UH-xxx" or AHU-xxx").
6. Components inside equipment enclosure, (e.g., controller’s, control relays, contactors, and timers):
   a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
   b. Fastener: Self.
   c. Legend:
      1) Letter height: 3/16 IN minimum.
      2) Description or function of component (e.g., "CR-xxx").
7. Through enclosure door mounted equipment (e.g., selector switches, controller digital displays, etc.):
   a. Tag type: Type C - Phenolic Name Plates.
   b. Fastener: Screws.
C. Electrical Systems:

1. Trenches with ductbanks, direct-buried conduit, or direct-buried wire and cable:
   a. Tag type: Type F - Underground Warning Tape.
   c. Location:
      1) Where trench is 12 IN or more below finished grade: In trench 6 IN below finished grade.
      2) Where trench is less than 12 IN below finished grade: In trench 3 IN below finished grade.
   d. Electrical power (e.g., low and medium voltage):
      1) Color: Red with black letters.
      2) Legend:
         a) First line: “CAUTION CAUTION CAUTION”.
         b) Second line: “BURIED ELECTRIC LINE BELOW”.
   e. Communications (e.g., telephone, instrumentation, LAN, SCADA):
      1) Color: Orange with black letters.
      2) Legend:
         a) First line: “CAUTION CAUTION CAUTION”.
         b) Second line: “BURIED COMMUNICATION LINE BELOW”.

2. Switchgear, switchboards and motor control centers:
   a. Tag type: Type C - Phenolic Name Plates.
   b. Fastener: Screws.
   c. Main equipment legend:
      1) Letter height:
         a) First line: 1 IN minimum.
         b) Subsequent lines: 3/8 IN minimum.
      2) First line: Equipment name (e.g., "MAIN SWITCHBOARD MSBxxx").
      3) Second line:
         a) Source of power (e.g., "FED FROM MCCxxx LOCATED IN ROOM xxx").
         b) Include the building name or number if the source is in another building.
      4) Third line: System voltage and phase (e.g., “480/277 V, 3PH”).
   d. Main and feeder device legend:
      1) Letter height: 3/8 IN minimum.
      2) Description of load (e.g., “MAIN DISCONNECT”, "PUMP Pxxx" or "PANELBOARD HPxxx").

3. Panelboards and transformers:
   a. Tag type: Type C - Phenolic Name Plates.
   b. Fastener: Screws.
   c. Legend:
      1) Letter height:
         a) First line: 3/8 IN minimum.
         b) Subsequent lines: 3/16 IN minimum.
      2) First line: Equipment name (e.g., "PANELBOARD LPxxx" or "TRANSFORMER Txxx").
      3) Second line (panelboards only): System voltage and phase (e.g., “208/120V, 3PH”).
      4) Third line:
         a) Source of power (e.g., "FED FROM MCCxxx LOCATED IN ROOM xxx").
         b) Include the building name or number if the source is in another building.

4. Transfer switches:
   a. Tag type: Type C - Phenolic Name Plates.
b. Fastener: Screws.

c. Legend:
   1) Letter height:
      a) First line: 3/8 IN minimum.
      b) Subsequent lines: 3/16 IN minimum.
   2) First line: Equipment name (e.g., "AUTOMATIC TRANSFER SWITCH
      ATSxxx").

5. Safety switches, separately mounted circuit breakers and motor starters, VFD’s, etc.:
   a. Tag type: Type C - Phenolic Name Plates.
   b. Fastener: Screws.
   c. Legend:
      1) Letter height: 1/4 IN minimum.
      2) First line: Description of load equipment is connected to (e.g., "PUMP Pxxx").

6. Enclosure for instrumentation and control equipment, (e.g., lighting control panels, etc.):
   a. Tag type: Type C - Phenolic Name Plates.
   b. Fastener: Screws.
   c. Legend:
      1) Letter height: 1/2 IN minimum.
      2) Equipment name (e.g., "LIGHTING CONTROL PANEL LCPxxx").

7. Components inside equipment enclosures (e.g., circuit breakers, fuses, control power
   transformers, control relays, contactors, timers, etc.):
   a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
   b. Fastener: Self.
   c. Legend:
      1) Letter height: 3/16 IN minimum.
      2) Description or function of component (e.g., "M-xxx", “CR-xxx” or “TR-xxx”).

8. Through enclosure door mounted equipment (e.g., selector switches, controller digital
   displays, etc.):
   a. Tag type: Type C - Phenolic Name Plates.
   b. Fastener: Screws.
   c. Legend:
      1) Letter height: 1/4 IN minimum.
      2) Component tag number as indicated on the Drawings or as defined by contractor
         (e.g., “HS-xxx”).

9. Conductors in control panels and in pull or junction boxes where multiple circuits exist.
   a. Tag type: Type D - Self-Adhesive Tape Tags.
   b. Fastener: Self.
   c. Tag conductor at both ends.
   d. Legend:
      1) Letter height: 1/8 IN minimum.
      2) Circuit number or wire number as scheduled on the Drawings or as furnished with
         the equipment.

10. Conductors in handholes and manholes.
    a. Tag type: Type A3 - Metal Tape Tags.
    b. Fastener: Nylon strap.
    c. Tag conductor at both ends.
    d. Legend:
       1) Letter height: 1/8 IN minimum.
       2) Circuit number or wire number as scheduled on the Drawings.

11. Grounding conductors associated with grounding electrode system in accordance with the
    following:
    a. Tag type: Type D - Self-Adhesive Tape Tags.
    b. Fastener: Self.
    c. Legend:
       1) Letter height: 1/8 IN minimum.
2) Function of conductor (e.g., "MAIN BONDING JUMPER", "TO GROUND RING", "TO MAIN WATER PIPE").

12. Flash protection for switchboards, panelboards, industrial control panels and motor control centers:
   a. Tag type: Type D - Self-Adhesive Tape Signs.
   b. Fastener: Self.
   c. Legend: Per NFPA 70.

13. Entrances to electrical rooms:
   a. Tag type: Type B2 - Nonmetallic Signs.
   b. Fastener: Screw or adhesive.
   c. Size: 5 IN x 7 IN.
   d. Location: Each door to room.
   e. Legend:
      1) OSHA Danger Sign.
      2) Description of Danger: “HIGH VOLTAGE, AUTHORIZED PERSONNEL ONLY”.

14. Equipment where more than one (1) voltage source is present:
   a. Tag type:
      1) Type B2 - Nonmetallic Signs.
      2) Type D - Self-Adhesive Tape Signs.
   b. Fastener:
      1) Screw or adhesive.
      2) Self.
   c. Size: 1-3/4 IN x 2-1/2 IN.
   d. Location: Exterior face of enclosure or cubical.
   e. Legend:
      1) OSHA Danger Sign.
      2) Description of Danger: “MULTIPLE VOLTAGE SOURCES”.

3.3 HAZARD AND SAFETY SIGNS

A. Provide 6 Hazard and Safety Signs:

   1. Type B2:
      2. Descriptions:
         a. “WARNING: HAZARDOUS CHEMICAL STORAGE AREA”
            1) Provide on exterior of door.
         b. “CAUTION: CHEMICAL GOGGLES REQUIRED IN THIS AREA”
            1) Provide on the exterior of door.
         c. Other descriptions as directed by Owner.

END OF SECTION
SECTION 10520
FIRE EXTINGUISHER

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes: Fire extinguisher.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 05505 - Metal Fabrications.

1.2 QUALITY ASSURANCE
A. Referenced Standards:
   1. FM Global (FM):
   2. National Fire Protection Association (NFPA):
      a. 10, Standard for Portable Fire Extinguishers.
   3. Underwriters Laboratories, Inc. (UL):

1.3 DEFINITIONS
A. Authority Having Jurisdiction (AHJ): Building official, fire chief, fire marshal or other individual having statutory authority.

1.4 SUBMITTALS
A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
B. Operation and Maintenance Manuals:
   1. See Specification Section 01342 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

1.5 DELIVERY, STORAGE, AND HANDLING
A. Deliver and install filled and charged extinguishers just prior to building occupancy.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Fire extinguishers:
      a. Amerex Corporation.
      b. Ansul Fire Protection.
c. Walter Kidde.
d. Potter - Roemer Inc.

2. Fire extinguisher signs:
   a. Seton.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MANUFACTURED UNITS

A. Fire Extinguisher (FEXT):
   1. Steel bodied, all metal top (head) and valves.
   2. Multi-purpose dry chemical with hose and horn.
   3. FM Approved.
   4. Provide one (1) UL rated 10A-120BC extinguisher.
   5. Finish: Red with epoxy finish coat.

B. Wall Brackets:
   1. Bracket type to fit specified extinguisher.
   2. Bracket to be finished in red or black enamel.

C. Fire Extinguisher Signage:
   1. Single faced: SETON #21999.
   2. Double faced: SETON #22001.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions and NFPA 10.
   1. Install units with extinguisher top not over 48 IN above floor.
   2. Install wall brackets to concrete or masonry substrate with stainless steel self-tapping concrete anchors.
      a. See Specification Section 05505.
   3. Coordinate extinguisher mounting location with the AHJ.

B. Provide "FIRE EXTINGUISHER" sign for each extinguisher location.
   1. Provide single or double faced sign to provide optimum visibility.

END OF SECTION
DIVISION  11

EQUIPMENT
SECTION 11005
EQUIPMENT: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements of this Specification Section apply to all equipment provided on the Project
   including those found in other Divisions even if not specifically referenced in individual
   "Equipment" Articles of those Specification Sections.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03002 - Concrete.
4. Section 05505 - Metal Fabrications.
5. Section 07900 - Joint Sealants.
6. Section 09905 - Painting and Protective Coatings.
7. Section 10400 - Identification Devices.
8. Division 11 - Equipment.
9. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.
10. Division 16 - Electrical.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Bearing Manufacturers Association (ABMA).
3. ASTM International (ASTM):
   a. E1934, Standard Guide for Examining Electrical and Mechanical Equipment with
      Infrared Thermography.
4. Hydraulic Institute (HI):
   a. 9.6.4, Centrifugal and Vertical Pumps for Vibration Measurements and Allowable
      Valves.
6. Institute of Electrical and Electronics Engineers, Inc. (IEEE).
   a. 1940, Mechanical Vibration - Balance Quality Requirements for Rotors in a Constant
8. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. ICS 6, Enclosures for Industrial Control and System.
   c. MG 1, Motors and Generators.
9. InterNational Electrical Testing Association (NETA):
      and Systems.
    a. 70, National Electrical Code (NEC):
       1) Article 430, Motors, Motor Circuits, and Controllers.
13. Occupational Safety and Health Administration (OSHA):
   a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
   a. 508, Standard for Safety Industrial Control Equipment.

B. Miscellaneous:
1. A single manufacturer of a "product" to be selected and utilized uniformly throughout Project even though:
   a. More than one (1) manufacturer is listed for a given "product" in Specifications.
   b. No manufacturer is listed.
2. Equipment, electrical assemblies, related electrical wiring, instrumentation, controls, and system components shall fully comply with specific NEC requirements related to area classification and to NEMA 250 and NEMA ICS 6 designations shown on Electrical Power Drawings and defined in Division 16.

1.3 DEFINITIONS

A. Product: Manufactured materials and equipment.

B. Major Equipment Supports - Supports for Equipment:
   1. Located on or suspended from elevated slabs with supported equipment weighing 2000 LBS or greater, or;
   2. Located on or suspended from roofs with supported equipment weighing 500 LBS or greater, or;
   3. Located on slab-on-grade or earth with supported equipment weighing 5000 LBS or more.

C. Equipment:
   1. One (1) or more assemblies capable of performing a complete function.
   2. Mechanical, electrical, instrumentation or other devices requiring an electrical, pneumatic, electronic or hydraulic connection.
   3. Not limited to items specifically referenced in "Equipment" articles within individual Specifications.

D. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:
   1. General for all equipment:
      a. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
      b. Data sheets that include manufacturer's name and complete product model number.
         1) Clearly identify all optional accessories that are included.
      c. Acknowledgement that products submitted comply with the requirements of the standards referenced.
      d. Manufacturer's delivery, storage, handling, and installation instructions.
      e. Equipment identification utilizing numbering system and name utilized in Drawings.
      f. Equipment installation details:
         1) Location of anchorage.
         2) Type, size, and materials of construction of anchorage.
         3) Anchorage setting templates.
         4) Manufacturer's installation instructions.
      g. Equipment area classification rating.
      h. Shipping and operating weight.

1. Equipment physical characteristics:
   1) Dimensions (both horizontal and vertical).
   2) Materials of construction and construction details.

j. Equipment factory primer and paint data.
k. Manufacturer's recommended spare parts list.
l. Equipment lining and coatings.
m. Equipment utility requirements include air, natural gas, electricity, and water.
n. Ladders and platforms provided with equipment:
   1) Certification that all components comply fully with OSHA requirements.
   2) Full details of construction/fabrication.
   3) Scaled plan and sections showing relationship to equipment.

2. Mechanical and process equipment:
   a. Operating characteristics:
      1) Technical information including applicable performance curves showing specified
         equipment capacity, rangeability, and efficiencies.
      2) Brake horsepower requirements.
      3) Copies of equipment data plates.
   b. Piping and duct connection size, type and location.
   c. Equipment bearing life certification.
   d. Equipment foundation data:
      1) Equipment center of gravity.
      2) Criteria for designing vibration, special or unbalanced forces resulting from
         equipment operation.

3. Electric motor:
   a. Motor manufacturer and model number.
   b. Complete motor nameplate data.
   c. Weight.
   d. NEMA design type.
   e. Enclosure type.
   f. Frame size.
   g. Winding insulation class and temperature rise.
   h. Starts per hour.
   i. Performance data:
      1) Locked rotor and full load current at rated terminal voltage and minimum
         permissible or specified terminal voltage.
   j. Fabrication and/or layout drawings:
      1) Dimensioned outlined drawing.
   k. Electrical gear:
      1) Unless specified in a narrow-scope Specification Section, provide the following:
         a) Equipment ratings: Voltage, continuous current, kVA, watts, short circuit with
            stand, etc., as applicable.

4. For factory painted equipment, provide paint submittals in accordance with Specification
   Section 09905.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 3304 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

C. Informational Submittals:
   1. Sample form letter for equipment field certification.
   2. Certification that equipment has been installed properly, has been initially started up, has
      been calibrated and/or adjusted as required, and is ready for operation.
   3. Certification for major equipment supports that equipment foundation design loads shown
      on the Drawings or specified have been compared to actual loads exhibited by equipment
      provided for this Project and that said design loadings are equal to or greater than the loads
      produced by the equipment provided.
4. Preliminary field quality control testing format to be used as a basis for final field quality control reporting.
5. Testing and monitoring reports in accordance with PART 3 of this Specification Section.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Motors:
   a. Baldor.
   b. General Electric.
   c. Marathon Electric.
   d. Reliance Electric.
   e. Siemens.
   g. U.S. Motors.
   h. WEG.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MANUFACTURED UNITS

A. General:

1. Furnished equipment manufacturer’s field quality control services and testing as specified in the individual equipment Specification Sections.
2. Execute pre-demonstration requirements in accordance with Specification Section 01650.
3. Perform and report on all tests required by the equipment manufacturer’s Operation and Maintenance Manual.
4. Provide testing of electrical equipment and connections in accordance with Division 16.
5. Equip testing and analysis personnel with all appropriate project related reference material required to perform tests, analyze results, and provide documentation including, but not limited to:
   b. Related construction change documentation.
   c. Approved Shop Drawings.
   d. Approved Operation and Maintenance Manuals.
   e. Other pertinent information as required.

B. Other Testing:

1. Perform tests and inspections not specifically listed but required to assure equipment is safe to energize and operate.
2. Subbase that supports the equipment base and that is made in the form of a cast iron or steel structure that has supporting beams, legs, and cross members that are cast, welded, or bolted shall be tested for a natural frequency of vibration after equipment is mounted.
   a. The ratio of the natural frequency of the structure to the frequency of the disturbing force shall not be between 0.5 and 1.5.

C. Electric Motors:

1. Design for frequent starting duty equivalent to duty service required by driven equipment.
2. Design for full voltage starting.
3. Size for altitude of Project.
4. Furnish with stainless steel nameplates which include all data required by NEC Article 430.
5. Use of manufacturer’s standard motor will be permitted on integrally constructed motor driven equipment specified by model number in which a redesign of the complete unit would be required in order to provide a motor with features specified.
6. AC electric motors less than 1/3 HP:
   a. Single phase, 60 Hz, designed for the supply voltage shown on the Drawings.
   b. Permanently lubricated sealed bearings conforming to ABMA standards.
   c. Built-in manual reset thermal protector or integrally mounted manual motor starter with
      thermal overload element with stainless steel enclosure.

7. AC electric motors 1/3 to 1 HP:
   a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
   b. Permanently lubricated sealed bearings conforming to ABMA standards.
      1) For single phase motors, provide built-in manual reset thermal protector or
         integrally mounted manual motor starter with thermal overload element.

D. NEMA Design Squirrel Cage Induction Motors:
   1. Provide motors designed and applied in compliance with NEMA and IEEE for the specific
      duty imposed by the driven equipment.
   2. Motors to meet NEMA MG 1 (NEMA Premium) efficiencies.
   3. Do not provide motors having a locked rotor kVA per HP exceeding the NEMA standard
      for the assigned NEMA code letter.
   4. Design motor insulation in accordance with NEMA standards for Class F insulation with
      Class B temperature rise above a 40 DegC ambient.
   5. Design motors for continuous duty.
   6. Size motors having a 1.0 service factor so that nameplate HP is a minimum of 15 percent
      greater than the maximum HP requirements of the driven equipment over its entire
      operating range.
      a. As an alternative, furnish motors with a 1.15 service factor and size so that nameplate
         HP is at least equal to the maximum HP requirements of the driven equipment over its
         entire operating range.
   7. Motor enclosure and winding insulation application:
      a. The following shall apply unless modified by specific Specification Sections:

<table>
<thead>
<tr>
<th>MOTOR LOCATION</th>
<th>MOTOR ENCLOSURE / WINDING INSULATION</th>
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<tbody>
<tr>
<td>Unclassified Indoor Areas</td>
<td>TEFC, Standard Insulation</td>
</tr>
<tr>
<td>Wet indoor Areas</td>
<td>TEFC, Standard Insulation</td>
</tr>
</tbody>
</table>

NOTE: Provide TENV motors in the smaller horsepower ratings where TEFC is not available.

E. V-Belt Drive:
   1. Provide each V-belt drive with sliding base or other suitable tension adjustment.
   2. Provide V-belt drives with a service factor of at least 1.6 at maximum speed.
   3. Provide static proof belts.

2.3 COMPONENTS

A. Gear Drives and Drive Components:
   1. Size drive equipment capable of supporting full load including losses in speed reducers and
      power transmission.
   2. Provide nominal input horsepower rating of each gear or speed reducer at least equal to
      nameplate horsepower of drive motor.
   3. Design drive units for 24 HR continuous service, constructed so oil leakage around shafts is
      precluded.
   4. Utilize gears, gear lubrication systems, gear drives, speed reducers, speed increasers and
      flexible couplings meeting applicable standards of AGMA.
2.4 ACCESSORIES

A. Guards:
   1. Provide each piece of equipment having exposed moving parts with full length, easily
      removable guards, meeting OSHA requirements.
   2. Interior applications:
      a. Construct from expanded galvanized steel rolled to conform to shaft or coupling
         surface.
      b. Utilize non-flattened type 16 GA galvanized steel with nominal 1/2 IN spacing.
      c. Connect to equipment frame with hot-dip galvanized bolts and wing nuts.
   3. Exterior applications:
      a. Construct from 16 GA stainless steel or aluminum.
      b. Construct to preclude entrance of rain, snow, or moisture.
      c. Roll to conform to shaft or coupling surface.
      d. Connect to equipment frame with stainless steel bolts and wing nuts.

B. Anchorage:
   1. Cast-in-place anchorage:
      a. Provide ASTM F593, Type 316 stainless steel anchorage for all equipment.
      b. Configuration and number of anchor bolts shall be per manufacturer's
         recommendations.
      c. Provide two (2) nuts for each bolt.
   2. Drilled anchorage:
      a. Adhesive anchors per Specification Section 05505.
      b. Epoxy grout.
      c. Threaded rods same as cast-in-place.

C. Data Plate:
   1. Attach a stainless steel data plate to each piece of rotary or reciprocating equipment.
   2. Permanently stamp information on data plate including manufacturer's name, equipment
      operating parameters, serial number and speed.

D. Gages:
   1. Provide at the following locations:
      a. Inlet and outlet of all reciprocating, centrifugal and positive displacement mechanical
         and process equipment.
      b. At locations identified on Drawings.
   2. Utilize tapping sleeves for mounting per Specification Section 15060.

E. Lifting Eye Bolts or Lugs:
   1. Provide on all equipment 50 LBS or greater.
   2. Provide on other equipment or products as specified in the narrow-scope Specification
      Sections.

F. Platforms and Ladders:
   1. Design and fabricate in accordance with OSHA Standards.

2.5 FABRICATION

A. Design, fabricate, and assemble equipment in accordance with modern engineering and shop
   practices.
B. Manufacture individual parts to standard sizes and gages so that repair parts, furnished at any
   time, can be installed in field.
C. Furnish like parts of duplicate units to be interchangeable.
D. Ensure that equipment has not been in service at any time prior to delivery, except as required by
   tests.
E. Furnish equipment which requires periodic internal inspection or adjustment with access panels which will not require disassembly of guards, dismantling of piping or equipment or similar major efforts.
   1. Quick opening but sound, securable access ports or windows shall be provided for inspection of chains, belts, or similar items.

F. Provide common, lipped base plate mounting for equipment and equipment motor where said mounting is a manufacturer's standard option.
   1. Provide drain connection for 3/4 IN PVC tubing.

G. Fabricate equipment which will be subject to Corrosive Environment in such a way as to avoid back to back placement of surfaces that can not be properly prepared and painted.
   1. When such back to back fabrication can not be avoided, provide continuous welds to seal such surfaces from contact with corrosive environment.
   2. Where continuous welds are not practical, after painting seal the back to back surfaces from the environment in accordance with Specification Section 07900.

H. Critical Speed:
   1. All rotating parts accurately machined and in as near perfect rotational balance as practicable.
   2. Excessive vibration is sufficient cause for equipment rejection.
   3. Ratio of all rotative speeds to critical speed of a unit or components: Greater than 1.2.

2.6 SHOP OR FACTORY PAINT FINISHES

A. Electrical Equipment:
   1. Provide factory-applied paint coating system(s) for all electrical equipment components except those specified in Specification Section 09905 to receive field painting.
      a. Field painted equipment: See Specification Section 09905 for factory applied primer/field paint compatibility requirements.

B. Field paint other equipment in accordance with Specification Section 09905.
   1. See Specification Section 09905 for factory applied primer/field paint compatibility requirements.

2.7 SOURCE QUALITY CONTROL

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment as shown on Drawings and in accordance with manufacturer's directions.

B. Utilize templates for anchorage placement for slab-mounted equipment.

C. For equipment having drainage requirements such as seal water, provide 3/4 IN PVC or clear plastic tubing from equipment base to nearest floor or equipment drain.
   1. Route clear of major traffic areas and as approved by Engineer.

D. DO NOT construct foundations until major equipment supports are approved.

E. Extend all non-accessible grease fittings using stainless steel tubing to a location which allows easy access of fittings from closest operating floor level.

F. Equipment Base:
   1. Construct level in both directions.
   2. Take particular care at anchor bolt locations so these areas are flat and level.
G. Couplings:
   1. Align in the annular and parallel positions.
      a. For equipment rotating at 1200 rpm or less, align both annular and parallel within 0.001 IN tolerance for couplings 4 IN size and smaller.
      b. For equipment rotating at speeds greater than 1200 rpm allow both annular and parallel positions within a tolerance rate of 0.00025 IN per inch coupling diameter.
2. If equipment is delivered as a mounted unit from factory, verify factory alignment on site after installation and realigned if necessary.
3. Check surfaces for runout before attempting to trim or align units.

3.2 INSTALLATION CHECKS
A. For all equipment specifically required in detailed specifications, secure services of experienced, competent, and authorized representative(s) of equipment manufacturer to visit site of work and inspect, check, adjust and approve equipment installation.
   1. In each case, representative(s) shall be present during placement and start-up of equipment and as often as necessary to resolve any operational issues which may arise.
B. Secure from equipment manufacturer's representative(s) a written report certifying that equipment:
   1. Has been properly installed and lubricated.
   2. Is in accurate alignment.
   3. Is free from any undue stress imposed by connecting piping or anchor bolts.
   4. Has been operated under full load conditions and that it operated satisfactorily.
      a. Secure and deliver a field written report to Owner immediately prior to leaving jobsite.
C. No separate payment shall be made for installation checks.
   1. All or any time expended during installation check does not qualify as Operation and Maintenance training or instruction time when specified.

3.3 IDENTIFICATION OF EQUIPMENT AND HAZARD WARNING SIGNS
A. Identify equipment and install hazard warning signs in accordance with Specification Section 10400.

3.4 FIELD PAINTING AND PROTECTIVE COATINGS
A. For required field painting and protective coatings, comply with Specification Section 09905.

3.5 WIRING CONNECTIONS AND TERMINATION
A. Clean wires before installing lugs and connectors.
B. Coat connection with oxidation eliminating compound for aluminum wire.
C. Terminate motor circuit conductors with copper lugs bolted to motor leads.
D. Tape stripped ends of conductors and associated connectors with electrical tape.
   1. Wrapping thickness shall be 150 percent of the conductor insulation thickness.
E. Connections to carry full ampacity of conductors without temperature rise.
F. Terminate spare conductors with electrical tape.

3.6 FIELD QUALITY CONTROL
A. Furnish equipment manufacturer services as specified in the individual equipment Specifications.
B. Inspect wire and connections for physical damage and proper connection.
C. Bump motor to check for correct rotation:
   1. Ensure motor has been lubricated.
   2. Check prior to connection to driven equipment.

D. Subbase that supports the equipment base and that is made in the form of a cast iron or steel
   structure that has supporting beams, legs and cross member that are cast welded or bolted, shall
   be tested for a natural frequency of vibration after equipment is mounted.
   1. Keep the ratio of the natural frequency of the structure to the frequency of the disturbing
      force out of the range from 0.5 to 1.5.

3.7 DEMONSTRATION

A. Demonstrate equipment in accordance with Specification Section 01650.

END OF SECTION
SECTION 11060
PUMPING EQUIPMENT: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Pumping equipment.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 09905 - Painting and Protective Coatings.
   4. Section 11005 - Equipment: Basic Requirements.

1.2 QUALITY ASSURANCE
A. Referenced Standards:
   1. Hydraulic Institute (HI):
B. Fully coordinate all mechanical seal systems specified to ensure pump and seal compatibility.

1.3 DEFINITIONS
A. The abbreviations are defined as follows:
   1. IPS: Iron Pipe Size.
   2. NPSHR: Net Positive Suction Head Required.
   3. TDH: Total Dynamic Head.
   4. TEFC: Totally Enclosed Fan Cooled.
   5. VFD: Variable Frequency Drive.
B. Pump Service Category: Pump or pumps having identical names (not tag numbers) used for specific pumping service.

1.4 SUBMITTALS
A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 11005.
   3. Product technical data including:
      a. Performance data and curves with flow (gpm), head (FT), horsepower, efficiency,
         NPSH requirements, submergence requirement.
      b. Pump accessory data.
      c. Bearing supports, shafting details and lubrication provisions.
         1) Bearing life calculations.
         2) Critical speed calculations.
   4. Certifications:
      a. Certified pump performance curves as described in the SOURCE QUALITY CONTROL Article.
5. Test reports:
   a. Factory hydrostatic test.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01342 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

C. Informational Submittals:
   1. Certifications:
      a. Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Pumps:
      a. See individual pump Specification Sections.
   2. Mechanical seals:
      a. Chesterton.
      b. Garlock.
      c. Or as noted in the individual pump Specification Sections.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 CENTRIFUGAL PUMP DESIGN

A. Provide units with increasing head characteristics from the end run out portion of the curve to shut-off condition.

2.3 ACCESSORIES

A. See Specification Section 11005.

B. Each Unit:
   1. Lifting eye bolts or lugs.
   2. Plugged gage cock connection at suction and discharge nozzles.
   3. Tapped and plugged openings for casing and bearing housing vents and drains.
   4. Fittings for properly adding flushing lubricant.
   5. Pressure relief fittings for grease lubrication.

C. Packing Seal:
   1. Provide packing unless mechanical seal is specified in narrow-scope pump sections.
   2. Minimum of five (5) rings graphite impregnated synthetic packing.
   3. Provide minimum 1/4 IN DIA supply tap and 1/2 IN DIA minimum drain tap.
   4. Provide split Teflon or bronze water seal ring.
   5. Adjustable split follower cast iron or bronze gland.

D. Mechanical Seals:
   1. Provide as specified in the narrow-scope pump sections.
   2. Provide balanced O-ring type.
   3. Provide oil lubrication - cooling.
   4. Materials:
      a. Metal parts except springs: 316 stainless steel.
      b. Springs: Hastelloy C.
      c. Seal faces: Unfilled carbon graphite versus silica-free Grade 99.5 ceramic.
2.4 FABRICATION

A. Pump Support:
   1. Design base to support weight of drive, shafting and pump.
   2. Comply with HI vibration limitations.
   3. Mount horizontal pump, motor and coupling on single piece drip lip type baseplate.
   4. Mount vertical pumps on single piece pedestal baseplate.
   5. Fabricate to withstand all operating loads transmitted from the pump and drive.

2.5 SOURCE QUALITY CONTROL

A. If specifically required in the individual pump specification sections, provide factory tests:
   1. All units:
      a. Conduct tests in accordance with HI.
      b. Hydrostatic test at 150 percent of shut-off head for a minimum of 5 minutes.
   2. Adjustable speed units:
      a. Head (FT) verses flow (gpm) pump curves:
         1) Maximum, minimum and two (2) equally spaced intermittent speeds.
         2) Efficiencies along each curve.
         3) Brake horsepower along each curve.
   3. Constant speed units:
      a. Head (FT) versus flow (gpm) pump curves:
         1) Efficiencies along curve.
         2) Brake horsepower along each curve.
   4. Results certified by a registered professional engineer.

B. Statically and dynamically balance each pump per HI standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Specification Section 11005.

B. Floor or Pad-Mounted Units (Non-Submersible):
   1. Align vertically and horizontally level, wedge and plumb units to match piping interfaces.
   2. Assure no unnecessary stresses are transmitted to equipment flanges.
   3. Tighten flange bolts at uniform rate and manufacturer's recommended torque for uniform gasket compression.
   4. Support and match flange faces to uniform contact over entire face area prior to bolting pipe flange and equipment.
   5. Permit piping connecting to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.
   6. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.
   7. Assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened.
      a. Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
      b. Realign as necessary, install flange bolts and make equipment connection.
   8. Field paint units as defined in Specification Section 09905.
   9. Provide pressure gage on discharge of all pumps and on suction and discharge of all non-submersible units.
C. Submersible Units:
   1. Assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint
      installed and tightened.
      a. Test alignment by loosening flange bolts to see if there is any change in relationship of
         piping flange with equipment connecting flange.
      b. Realign as necessary, install flange bolts and make equipment connection.
   2. Field paint units as defined in Specification Section 09905.
   3. Provide pressure gage on discharge of all pumps and on suction and discharge of all non-
      submersible units.

3.2 FIELD QUALITY CONTROL

A. Provide services of equipment manufacturer's field service representative(s) to:
   1. Inspect equipment covered by this Specification Section.
   2. Supervise pre-start adjustments and installation checks.
   3. Conduct initial startup of equipment and perform operational checks.
   4. Instruct Owner's personnel for the specified minimum number of hours at jobsite per
      Specification Section 01060 on operation and maintenance of each of following pumping
      equipment:

END OF SECTION
SECTION 11065
PUMPING EQUIPMENT: SUMP

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes: Submersible sump pumps.
B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

1.2 QUALITY ASSURANCE
A. Referenced Standards:
   1. ASTM International (ASTM):
   2. National Fire Protection Association (NFPA):

1.3 SUBMITTALS
A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.

B. Operation and Maintenance Manuals:
   1. See Section 01340 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Hard pipe submersible sump pumps SUPP-01:
      a. Zoeller M53.
      b. Approved equal.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS
A. SUPP-01:
   1. Pump casing:
   2. Impeller:
      a. Glass-filled plastic with metal insert.
2.3 EQUIPMENT

A. Performance and Configuration Requirements:
   1. SUPP-01:
      a. Design condition: 38 gpm at 8.5 FT TDH.
      b. Secondary condition: 42.5 gpm at 5 FT TDH.
      c. Shut-off condition: 0 gpm at 19 FT TDH.
      d. Pump configuration: Submersible.
      e. Electrical: 115 V, 1 PH, 6.7 AMP (Max).
      f. Drive type: Constant speed.
      g. Drive configuration: Direct coupled.
      h. Minimum solids passage: 5/8 IN.

2.4 ACCESSORIES

A. SUPP-01:
   1. Controls:
      a. Provide push button to turn pump on.
         1) Pump shall not be able to turn on by float switch.
      b. Pump to be turned off by low level float indication.
      c. Gas tight float switch.
         1) Pump “OFF”.
      d. NEMA 4X enclosure.
      e. Panel face mounted push button:
         1) Pump “ON”.
      f. Panel face mounted indicator lights:
         1) Pump “ON”.
         2) Pump “OFF”.
      g. Control panel to include pump motor starter and associated pump controls for complete
         operation of pumping system from single electrical feed to panel.
   2. Lifting chains and cables:
      b. Provide 4 FT of chain to allow removal of pump.
      c. Provide 304 SS hook on wall to attach end of chain.

2.5 FABRICATION

A. General:
   1. Pump casing uniform and free from blowholes or other defects and designed to withstand
      150 percent of shutoff head.
   2. Equipped with bolted-on strainer with opening equal to specified solids passage of pump.

B. Impeller:
   1. Non-clog.
   2. Key to pump shaft with same material as shaft.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with requirements of Pump Manufacturer.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Peristaltic chemical metering pumps.

B. Chemical Feed Pumps:
   1. This Specification covers the supply and testing of completely functional skid-mounted peristaltic chemical metering pump feed systems.
      a. The chemical feed system shall include multiple skid assemblies containing chemical feed pumps, all necessary piping, valves, fittings, supports, electrical controls and accessories as shown on Drawings and as specified herein.

C. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 11060 - Pumping Equipment: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Gear Manufacturers Association (AGMA).
   2. American Society of Mechanical Engineers (ASME):
   3. ASTM International (ASTM):
   4. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

B. For the purpose of establishing quality assurance, experience, and system reliability, all chemical feed pumps and components shall be preassembled onto a skid-mounted system by the pump manufacturer or fabrication shop experienced in construction of chemical feed pump skids (must be able to provide documented installation list for similar sizes pumps and chemicals pumped). Skid mounted systems are to be shop-tested for capacity and pressure prior to shipment with documented results provided.

C. The chemical pumping equipment shall be the product of or supplied by a single pump manufacturer who has designed and manufactured similar skid mounted feed systems and equipment, and has a record of a minimum of five (5) years or more of successful operation of such equipment in the field.

D. To ensure pump performance and accuracy, only tubing provided by the manufacturer is acceptable.

E. Drive and pumpheads shall be 24 HR continuous duty rated and have a 5-year manufacturer's warranty from date of shipment.

F. Pumps to be manufacturer's standard product. Manufacturer of tubing pumps must have at least 20 operating installations in domestic water or wastewater treatment plants located in the United States over a period of at least seven years in the same size as specified.

G. Pumps shall be meet all applicable CE and C ETL US standards per UL 610101A.
135-230216-003 Watertown WWTF
Alkalinity Feed Addition -
PUMPING EQUIPMENT: PERISTALTIC

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1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. See Section 11060.

B. Miscellaneous Submittals: See Section 11060.

C. Operating and Maintenance Manuals:
   1. See Section 01340 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Watson Marlow. 500 Series and 600 Series.

2.2 MATERIALS

A. Sodium Hydroxide Feed Pumps: SHFP-01 and SHFP-02.
   1. Hose: Material is to be as recommended by pump manufacturer to provide the longest life and be the most chemical resistant to 30 to 50 percent sodium hydroxide. Manufacturer must include in the shop drawing submittal a recommendation of material and stating that it is the most desirable material selection for the specific chemical.
   4. Rotor bearing seal: PFTE
   5. Shaft: Chrome plated steel or 316 stainless steel.

2.3 EQUIPMENT

A. Performance and Design Requirements:
   1. Sodium Hydroxide Feed Pumps: SHFP-01 and SHFP-02.
      a. Pumped liquid: 30-50 percent sodium hydroxide.
      b. Design conditions: Flow range 1-200 GPD with maximum pump pressure of 30 psi.
      c. Maximum pump speed at maximum design flow: 200 rpm.
      d. Voltage: 115 V.
      e. Drive type: Variable speed.
      f. Provide a removable plexi-glass splash guard to cover the top and front of the pump skid.

2.4 ACCESSORIES

A. See Section 11005.
B. See Drawings for accessories to be included on skid, included but not limited to the following:

1. Skid-mounted feed system:
   a. The skid mounting of the metering pumps shall conform to the following requirements:
      1) The chemical feed system shall be completely assembled, mounted, calibrated, tested, and delivered to the site.
         a) Components to be mounted on the skid shall include the metering pumps, controller(s), calibration column, piping, valves, piping accessories (pulsation dampeners, strainers, pressure relief valves, etc.), and wiring integral to the skid.
      2) The skid shall be constructed of 1/2 IN HDPE, fusion welded polypropylene sheets or powder coated aluminum with adequate supports for all equipment and piping.
      3) All components of the skid-mounted system (pumps, piping and controls) shall be factory tested.
   b. Skid-mounted accessories to include the following:
      1) Calibration chamber:
         a) A clear plastic vented calibration chamber shall be provided for each metering pump in accordance with the following:
            (1) The chamber shall be sized to give adequate capacity for a minimum 30-second draw down test.
            (2) The scale shall give direct readings in mL and GPH without the need for calculations.
            (3) The calibration chamber shall be piped and valved so that the pump is able to utilize the calibration chamber without interfering with the operation of other pump.
            (4) The calibration chamber shall be piped and valves so that the column can be filled with pumped flow.
            (5) The top of the chamber shall have a flanged fitting to allow for piping to a vent.
      2) Pulsation dampeners:
         a) A pulsation dampener capable of arresting pulsing created by the metering pumps in the discharge line shall be provided for each metering pump.
            (1) Materials of construction of diaphragm and body shall be corrosion resistant to the chemical fluid pumped.
      3) Pressure relief valves:
         a) Adjustable diaphragm pressure relief valves shall be installed on the pump discharge header and set at location recommended by the pump manufacturer.
         b) Valve construction shall be of materials suitable for use with the specific chemical pumped.
      4) Pressure gage and diaphragm isolator:
         a) Provide a pressure gage and diaphragm type chemical isolator suitable for use with the specific chemical pumped.
         b) Range of pressure gage to be suitable for application.
      5) Piping:
         a) All skid piping shall be Schedule 80 PVC.
         b) Primer and cement shall be as specified in Section 15060.
         c) True unions to be utilized to allow for disassembly without cutting piping (see Section 15060).
      6) Pipe supports: Pipe connections to pumps shall be firmly supported from skid-mounted supports to avoid any stress on the pumps or on the piping system via PVC or FRP struts, clamps and accessories (see section 15090).
2.5 FABRICATION

A. General:
   1. Pumps shall be positive displacement peristaltic, self-contained variable speed drive, and flexible extruded tube as specified.
   2. Peristaltic pumping action is created by the compression of the flexible tube between the pump head rollers and track, induced forward fluid displacement within the tube by the rotation of the pump rotor, and subsequent vacuum-creating restitution of the tube.
   3. Pumps shall be dry self-priming, capable of being run dry without damaging effects to pump or tube, and shall have a maximum suction lift capability of up to 30 FT vertical water column and capable of achieving a pumping pressure of 30 psi.
   4. Pump shall not use check valves or diaphragms and shall not require dynamic seals in contact with the pumped fluid. Process fluid shall be contained within pump tubing and shall not directly contact any rotary or metallic components.
   5. Flow shall be in the direction of the rotor rotation, which can be reversed and shall be proportional to rotor speed.
   6. Pump tubing shall be in contact with the inside diameter of the track through an angle of 180 degrees and be held in place on the suction and discharge by a spring loaded self-adjusting clamp mechanism. At all times, one roller shall be fully engaged with the tubing providing complete compression and preventing back flow or siphoning.
   7. Pumphead guard shall be transparent for purpose of viewing direction of rotation. For operator and environmental safety, pumps in which the direction of rotation cannot be visually verified are not acceptable.

B. Pump Drive System:
   1. Rating: Continuous 24 HR operation, 40 DegC ambient.
   3. Enclosure: NEMA 4X.

C. Operator Interface:
   1. Pumps must meet the following minimum requirements for operator interface functionality.
   2. Backlit graphical LCD capable of up to four lines of text with up to 16 characters per line to display pump speed, running status, flow rate, and programming instructions
   3. Keypad for start, stop, speed increment, speed decrement, forward/reverse direction, rapid prime, and programming.
   4. Menu driven on screen programming of manual or auto control, flow and remote signal calibration, and general programming.
   5. Programmable “Auto Restart” feature to resume pump status in the event of power outage interruption.
   6. Programmable “Keypad Lock” to allow operator lockout of all keys except emergency start/stop.
   7. Programmable “Maximum Speed” to allow operator to set the maximum speed of the pump.
   8. Drive motor- brushless DC motor with integral gearbox and tachometer feedback.
      a. Speed Control Range of 2200:1 minimum ±0.1 rpm throughout the range.
      b. Closed loop microprocessor controlled drive.
      c. Circuitry complete with temperature and load compensation and protection.
   9. Mounting: Drive shall be self-supporting and shall not require anchoring.

2.6 SOURCE QUALITY CONTROL

A. See Section 11060.

B. Hydrostatic test unit a 150 percent of maximum specified discharge pressure or at 20 psig, which ever is greater.

C. Inlet Vacuum Test.
PART 3 - EXECUTION

3.1 INSTALLATION
A. See Section 11060.

3.2 FIELD QUALITY CONTROL
A. See Section 11060.

END OF SECTION
PUMPING EQUIPMENT: PERISTALTIC
DIVISION 13
SPECIAL CONSTRUCTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fiberglass reinforced plastic (FRP) tanks for chemical applications.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

1.2 QUALITY ASSURANCE

A. Reference Standards:
   1. American Society of Mechanical Engineers (ASME):
   2. ASTM International (ASTM):
         Used in Glass-Fiber-Reinforced Structures Intended for Liquid Service.
      c. D2583, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a
         Barcol Impresor.
      e. D3299, Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset
         Resin Corrosion-Resistant Tanks.
      f. D4097, Standard Specification for Contact-Molded Glass-Fiber-Reinforced Thermoset
         Resin Corrosion-Resistant Tanks.
      3. Occupational Safety and Health Administration (OSHA).
   4. Building Code:
      a. International Code Council (ICC):
            amendments, referred to herein as Building Code.
      B. Furnish written qualifications and experience list including:
      1. Minimum of three (3) installations constructed in the last five (5) years of similar size and
         chemical requirements.
      2. Owner’s address, name and phone number.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal
      process.
   2. See Section 11005.
   3. Information documenting manufacturer’s experience, per Article 1.2.
   4. Product technical data:
      a. Certification for each vessel that design and materials are suitable for long-term
         chemical storage of defined chemical at specified concentrations.
      b. Complete information on basic materials including chemical resistance charts.
      c. Verification of chemical/resin compatibility.
      d. Detailed description of composition for each FRP laminate, including materials in each
         layer, thickness of each layer, overall thickness and exterior gel coating, ASTM or other
         standard that it conforms to and where each laminate is utilized.
      e. Sizes and locations of all tank components and fittings for each tank.
f. Details on nozzles and other openings.
g. Details on field assembly and installation.
h. Manufacturer's gel coat color selection guide.
i. Source quality control test reports.
j. Tie down locations and anchor bolt sizing.
k. Calculations stamped by a professional engineer documenting tankage and tank hold-down design in compliance with the Contract Documents.
l. Manufacturer's recommendations for torque to be applied for connections at tank flanges.

B. Miscellaneous Submittals:
   1. See Section 11005.
   2. Submit source quality control logs and reports after tank fabrication and minimum two (2) weeks before shipment.
   3. Tank cutouts from source quality control.

C. Operation and Maintenance Manuals:
   1. See Section 01340 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

1.4 PRODUCT DELIVERY, HANDLING AND STORAGE

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Belding Tank Technologies, Belding, MI.
   2. Design Tanks, Inc., Sioux Falls, SD.

2.2 DESIGN REQUIREMENTS

A. Design loads:
   1. Seismic requirements: See Sheet 00S001.
   2. Concentrated top load: 250 LB point load on 4 IN x 4 IN area.

B. Design Pressures:
   1. Minimum design pressure: 6 IN WC.
   2. Minimum design vacuum: -1 IN WC.

C. Content Characteristics:

<table>
<thead>
<tr>
<th>CONTENTS STORED AS</th>
<th>SPECIFIC GRAVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Hydroxide 50% NaOH</td>
<td>1.53</td>
</tr>
</tbody>
</table>

D. Sizes and Capacities: See schedule in PART 3.

2.3 MATERIALS

A. Fiberglass reinforced polyester.
   1. Premium vinyl ester resins.

B. Comply with ASTM D3299, ASTM C581 and ASTM D4097.

C. Materials and hardware utilized for interior fill pipes to be nonmetallic, compatible with chemical stored, not subject to corrosion or deterioration.
D. Materials for lifting and tie-down lugs to be 304 stainless steel.
E. Materials for miscellaneous exterior connections to be 316 stainless steel.
F. All gaskets to be rated superior for respective chemical applications.
G. Exterior layer: pigmented gel coat with UV inhibitors.
H. Interior surface layer: synthetic surfacing veil (Nexus TD).
   1. Free of thixotropic agents (viscosity control agents) and fillers
I. Inner corrosion barrier: free of thixotropic agents (viscosity control agents) and fillers.

2.4 FABRICATION AND MANUFACTURE

A. General: Per ASTM D3299, ASTM D4097, and as specified herein, the more stringent requirement to govern.

B. Tanks:
   1. Helical or chop hoop filament-wound side walls and contact molded top and base construction.
   2. Provide tanks with and inner surface layer, inner corrosion barrier, and structural layers.
   3. Manufactured from premium grade materials designed for long life for the chemical and concentration specified.
      a. Utilize corrosion resistant vinyl ester resin that has been determined by previous documented service to be acceptable for the specified chemical and conditions.
      b. Provide double surfacing veils on the interiors of the tanks for premium corrosion protection.
      c. No metal materials used on tank interiors.
   4. Minimum design safety factors and wall thickness per governing standard but not less than the following:
   5. Make all tank joints with heavy reinforced lay-ups for structural stability and to prevent leakage.
   6. Inner surface layer:
      a. 20 mils minimum thickness.
      b. 2 ply (10 mil each).
         1) Separately gel each ply.
      c. Resin content: 80 percent by weight.
   7. Inner corrosion barrier
      a. 120 mils minimum thickness.
      b. Resin rich with 2-ply chopped strand mat (Type E).
      c. Resin content: 80 percent by weight.
   8. Flanged nozzles:
      a. Orient and size as shown on Drawings.
      b. Conically gusseted to tank.
      c. Flange diameter and drilling per ASME B16.5, 150 LB.
      d. Same material as tank.
      e. Nozzles with threaded connections not acceptable.
      f. Press molded flanges not allowed.
      g. PVC flanges on vents attached to vessel not allowed.
      h. Extend nozzles for instrumentation minimum 6 IN from tank to flange.
      i. Provide piping flanged nozzles rated at a minimum of 100 psi.
      j. Provide manway flanged nozzles rated at a minimum of 15 psi.
   9. Storage tank suction nozzles:
      a. Siphon drain design on all nozzles.
      b. Provide FRP pipe extending within the tank and bending at a 45 degree angle down to within 1 IN of the bottom of the tank.
c. Design siphon drain to be rigid and require no interior supports.

10. Place invert elevation of overflow nozzles per Drawings.

11. Provide two FRP mounting lugs adjacent to each level transmitter nozzle and level switch nozzle for attaching electrical junction boxes.

12. Side manways and top access flanges:
   a. Dimension and location as scheduled on Drawings.
   b. Provide bolted and gasketed manways and top access flanges.
   c. Gasket with compatible gasket material.
   d. Flange diameter and drilling per ASME B16.5.
   e. 40-50 durometer 1/8 IN thick full-faced gaskets.

13. Exterior pipe supports on tanks:
   a. Provide to support piping (including horizontal feed lines, valves and vents), motorized valves and electrical conduits that interface with tank structure.
   b. Designed to allow easy installation or removal of the pipe or conduit.
   c. Place vertical supports spaced at 4 FT OC and within 1 FT of fittings or valves.

14. Interior fill pipes for each tank:
   a. Schedule 80 PVC pipe extending from inlet connection to 9 IN above tank bottom.
   b. Interior flanged connection to tank nozzle at top, and base support for 90 degree elbow at bottom.
   c. Pipe size to match exterior fill pipe.
   d. Pipe supports at 4 FT maximum, designed for easy pipe removal and replacement.
   e. 3/4 IN DIA by 6 IN long horizontal FRP vacuum breaking pipe from interior tank nozzle at top of tank, and pointed toward tank center.
   f. Provide 3/8 IN x 12 IN x 12 IN FRP wear pad, located below the fill pipe, to prevent scouring from product fill.

15. Tank top surface: Provide non-slip surface on top of storage tanks.

16. Provide a minimum of three lifting lugs capable of withstanding weight of tank with a safety factor of 3 to 1.

17. Tie-down lugs: Number, strength, location and anchor bolt size as required per design loading.

18. Provide minimum of two (2) stainless steel clips for connecting safety harnesses on top of each storage tank, rated at 300 LBS each.

19. Tank curing:
   a. Cure at 90 percent of the minimum Barcol hardness specified by the resin manufacturer.
   b. Cure sodium hypochlorite tanks using BPO/DMA system.
   c. Post cure at 80 degrees C for 4 hours (confirm with resin manufacturer).

C. Tank Accessories:

1. Overflow Vent Prevention Containers:
   a. Provide Polyethylene containers with loose fitting split lids for all tanks.
   b. Provide dimensions per Drawing detail.
   c. Extend overflow pipes through 6 IN DIA holes in the lids.
   d. Provide a 3/4 IN hose bib at each tank bottom to facilitate draining the tank.

2. Sight/Glass:
   a. Provide each tank with a 1 IN DIA clear PVC sight glass assembly as shown on the Drawings.
   b. Calibrate sight glass with 100 GAL minor increments and 500 GAL major increments.

3. Provide certification label on exterior of each tank identifying:
   a. Chemical contents, including concentration, specific gravity and maximum allowable temperature of contents.
   b. Exterior resin.
   c. Interior resin.
   d. Tank capacity below overflow.
   e. Manufacturer.
   f. Manufacturer location.
   g. Date of manufacture.
2.5 SOURCE QUALITY CONTROL

A. Manufacturer’s quality assurance program may be either an in-house program or retained from qualified outside source.

B. Utilize quality control manager experienced in the FRP industry.

C. Maintain fabrication and testing log for each vessel.
   1. Document the following:
      a. Each level of quality control inspection.
      b. Production personnel that worked on vessel.
      c. Quantity and type of materials used for vessel construction.
      d. Settings of production equipment used during fabrication.
      e. Results of visual inspections for individual vessel components before and after final assembly.
      f. Hydrostatic test of each tank at tank capacity for 4 HRS before shipment.
      g. Inspect each tank for defects in accordance with requirements of ASTM 3299 and other applicable ASTM standards before shipment.
      h. Provide a written certification by the quality control manager that each tank was manufactured in accordance with these Specifications.

D. Test vessel cutouts to verify glass content and degree of cure in accordance with ASTM D2584 and ASTM D2583.
   1. Mark and transmit cutouts within two weeks after tanks have been shipped.

E. Assure all areas of facility where vessels are manufactured or stored are available for inspection by Owner's representative during normal working hours.

F. Allowable Surface Tolerances:
   1. Cracks: None.
   2. Crazing (fine surface cracks): None.
   3. Blisters: None.
   4. Wrinkles: Maximum deviation 10 percent of wall thickness, but not exceeding 1/8 IN.
   5. Pits:
      a. Maximum dimension: 1/8 IN DIA x 1/32 IN deep.
      b. Maximum number: 10 SF.
   6. Surface porosity: None.
   7. Chips: None.
   8. Dry spot: None.
   9. Entrapped air (bubbles or voids in the laminate):
      a. Maximum density of 2 SQ IN at a maximum diameter of 1/16 IN.
      b. Maximum density of 2 SF at a maximum diameter of 1/8 IN.
      c. None to depth of 1/32 IN.
   10. Exposed glass: None.
   11. Burned areas: None.
   12. Exposure of cut edges: None.
   13. Scratches: None.
   14. Foreign matter: None.

PART 3 - EXECUTION

3.1 INSPECTION

A. Testing Before Equipment is Attached:
   1. Plug outlets.
   2. Fill with chemically compatible liquid to the overflow elevation.
3. Each tank must maintain the overflow elevation level with zero leakage for a 24 HR period.
4. Repair all leaks in accordance with manufacturer’s instructions.

B. Owner or his designated representative may inspect the fabrication and manufacturing process with a 24 HR prior notice given to manufacturer.

3.2 INSTALLATION

A. Per manufacturer’s recommendations.

B. Each tank will need to be delivered in two sections to allow the tanks to be brought in through the existing double door. Tanks will then need to be reassembled and fiberglass molded together on-site. The tank joint shall be made leak tight.

C. Torque bolts at flanged connections to manufacturer’s recommendations.

D. Storage Tank Concrete Support Pads:
   1. Install two (2) layers of 30 LB roofing felt as a buffer between concrete tank support pad and tank bottom.
   2. When applying the roofing felt, assure there are no overlaps or wrinkles causing ridges under the bottom.

E. Cleaning:
   1. With mild soap solution.
   2. Rinse with water.

3.3 TANK SCHEDULE

A. See Drawings for General Tank Configuration and definition of effective volume.

<table>
<thead>
<tr>
<th>STORAGE TANKS</th>
<th>EFFECTIVE VOLUME (GALLONS)</th>
<th>DIAMETER (FEET)</th>
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</thead>
<tbody>
<tr>
<td>SODIUM HYDROXIDE STORAGE TANK SHTK-01</td>
<td>6,000</td>
<td>10</td>
</tr>
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</table>

END OF SECTION
SECTION 15060
PIPE AND PIPE FITTINGS: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Process piping systems.
2. Utility piping systems.
3. Plumbing piping systems.

B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
4. Section 09905 - Painting and Protective Coatings.
5. Section 10400 - Identification Devices.
7. Section 15090 - Pipe Support Systems.
8. Section 15100 - Valves: Basic Requirements.
9. Section 15183 - Pipe, Duct and Equipment Insulation.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
1. American Association of State Highway and Transportation Officials (AASHTO):
   a. M36, Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains (Equivalent ASTM A760).
3. American Society of Mechanical Engineers (ASME):
   d. B16.22, Wrought Copper and Bronze Solder - Joint Pressure Fittings.
   e. B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
   g. B40.100, Pressure Gauges and Gauge Attachments.
4. ASTM International (ASTM):
   e. A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.


m. A760, Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.


q. C14, Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.


w. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.


5. American Water Works Association (AWWA):


b. C200, Standard for Steel Water Pipe - 6 IN and Larger.

c. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.


e. C606, Standard for Grooved and Shouldered Joints.

f. C651, Standard for Disinfecting Water Mains.

g. C800, Standard for Underground Service Line Valves and Fittings.


1.3 DEFINITIONS

A. Hazardous Gas Systems: Sulfur dioxide gas, carbon dioxide gas, lab gases.

B. PVDF: Polyvinylidene fluoride.

1.4 SYSTEM DESCRIPTION

A. Piping Systems Organization and Definition:
1. Piping services are grouped into designated systems according to the chemical and physical properties of the fluid conveyed, system pressure, piping size and system materials of construction.
2. See PIPING SPECIFICATION SCHEDULES in PART 3.

1.5 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.
   c. Separate schedule sheet for each piping system scheduled in this Specification Section showing compliance of all system components.
      1) Attach technical product data on gaskets, pipe, fittings, and other components.
3. Fabrication and/or layout Drawings:
   a. Exterior yard piping Drawings (minimum scale 1 IN equals 10 FT) with information including:
      1) Dimensions of piping lengths.
      2) Invert or centerline elevations of piping crossings.
      3) Acknowledgement of bury depth requirements.
      4) Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, and related appurtenances.
      5) Acknowledge designated valve or gate tag numbers, manhole numbers, instrument tag numbers, pipe and line numbers.
      6) Line slopes and vents.
   b. Interior piping drawings (minimum scale 1/8 IN equals 1 FT) with information including:
      1) Dimensions of piping from column lines or wall surfaces.
      2) Centerline dimensions of piping.
      3) Centerline elevation and size of intersecting ductwork, conduit/conduit racks, or other potential interferences requiring coordination.
      4) Location and type of pipe supports and anchors.
      5) Locations of valves and valve actuator type.
6) Details of fittings, tapping locations, equipment connections, flexible expansion joints, connections to equipment, and related appurtenances.
7) Acknowledgement of valve, equipment and instrument tag numbers.
8) Provisions for expansion and contraction.
9) Line slopes and air release vents.
10) Rough-in data for plumbing fixtures.

B. Operation and Maintenance Manuals:
1. See Specification Section 01342 for requirements for:
   a. The mechanics and administration of the submittal process.
   b. The content of Operation and Maintenance Manuals.

C. Informational Submittals:
1. Qualifications of lab performing disinfection analysis on water systems.
2. Test reports:
   a. Copies of pressure test results on all piping systems.
   b. Reports defining results of dielectric testing and corrective action taken.
   c. Disinfection test report.
   d. Notification of time and date of piping pressure tests.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe coating during handling using methods recommended by manufacturer.
1. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.

B. Prevent damage to pipe during transit.
1. Repair abrasions, scars, and blemishes.
2. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Insulating unions:
   a. "Dielectric" by Epco.
2. Dirt strainers (Y type):
   b. Sarco.
   c. Armstrong.
3. Chemical strainers (Y type):
   a. Chemtrol.
   b. Asahi.
4. Dry disconnect couplings:
   a. Kamlock.
5. Dielectric flange kit:
   a. PSI.
   b. Maloney.
   c. Central Plastics.
6. Pipe saddles (for gage installation):
   a. Dresser Style 91 (steel and ductile iron systems).
   b. Dresser Style 194 (nonmetallic systems).
7. Expansion joint at FRP and poly tanks:
   a. PROCO.

B. Submit request for substitution in accordance with Specification Section 01640.
2.2 PIPING SPECIFICATION SCHEDULES

A. Piping system materials, fittings and appurtenances are subject to requirements of specific piping specification schedules located at the end of PART 3 of this Specification Section.

2.3 COMPONENTS AND ACCESSORIES

A. Insulating Components:
   1. Dielectric flange kits:
      a. Flat faced.
      b. 1/8 IN thick dielectric gasket, phenolic, non-asbestos.
      c. Suitable for 175 psi, 210 DegF.
      d. 1/32 IN wall thickness bolt sleeves.
      e. 1/8 IN thick phenolic insulating washers.
   2. Dielectric unions:
      a. Screwed end connections.
      b. Rated at 175 psi, 210 DegF.
      c. Provide dielectric gaskets suitable for continuous operation at union rated temperature and pressure.

B. Dirt Strainers:
   1. Y-type.
   2. Composition bronze.
   3. Rated for test pressure and temperature of system in which they are installed.
   4. 20 mesh Monel screen.
   5. Threaded bronze plug in the blowoff outlet.
   6. Threaded NPT end connections.

C. Strainers for Chemical Applications:
   1. Y-type.
   2. Strainers of same material, test pressure, and temperature rating as system in which strainer is placed.

D. Reducers:
   1. Furnish appropriate size reducers and reducing fittings to mate pipe to equipment connections.
   2. Connection size requirements may change from those shown on Drawings depending on equipment furnished.

E. Protective Coating and Lining:
   1. Include pipe, fittings, and appurtenances where coatings, linings, paint, tests and other items are specified.
   2. Field paint pipe in accordance with Specification Section 09905.

F. Underground Warning Tape: See Specification Section 10400.

G. Pressure Gages:
   1. See Specification Section 11005.

H. Dry Disconnect Couplings:
   1. Adapters:
      a. Male adapters: Size shown on Drawings.
      b. Adapters:
         1) Female NPT end connection for sludge and flush applications.
         2) Male NPT end connection for chemical applications.
      c. Construct adapters for sludge applications from cast iron or steel.
      d. Construct adapters for chemical and PVC system applications 3 IN and below from polypropylene.
         1) Above 3 IN size, provide stainless steel units.
2. Couplers:
   a. Built-in valve and spring loaded poppet which close automatically when disconnected.
   b. Designed to remain with only one (1) arm locked in closed position.
   c. Construct couplers for sludge applications fabricated from material utilized for adapters.
   d. Construct couplers for chemical and PVC system applications 3 IN and less from polypropylene with stainless steel arms and pins.
      1) Above 3 IN, provide stainless steel units.
   e. Gasket: Compatible with conveyed liquid.
3. Dust caps: For all adapters.

I. Sacrificial Anode Cathodic Protection:
   1. 3 LB magnesium sacrificial anodes, prepackaged in a cloth bag containing 75 percent hydrated gypsum, 20 percent bentonite and 5 percent anhydrous sodium sulphate.
   2. TW 600 V or an HMWPE insulated copper lead attached to the anode.

J. Valves:
   1. See schematics and details for definition of manual valves used in each system under 4 IN in size.
   2. See Specification Section 15100.

K. Expansion Joints at FRP and Poly Tanks:
   1. Materials:
      b. Flanges: PVC, ductile iron.
      c. Limit bolts and nuts: 316 stainless steel epoxy coated carbon steel.
      d. Reinforcing rings: Stainless steel.
   2. Pressure rating at 70 DegF: 70 psig.
   3. Minimum axial movement: 3/8 IN.

PART 3 - EXECUTION

3.1 EXTERIOR BURIED PIPING INSTALLATION

A. Unless otherwise shown on the Drawings, provide a minimum of 6 FT earth cover over exterior buried piping systems and appurtenances conveying water, fluids, or solutions subject to freezing.

B. Enter and exit through structure walls, floors, and ceilings by using penetrations and seals specified in Specification Section 01800 and as shown on Drawings.

C. When entering or leaving structures with buried mechanical joint piping, install joint within 2 FT of point where pipe enters or leaves structure.
   1. Install second joint not more than 6 FT nor less than 4 FT from first joint.

D. Install expansion devices as necessary to allow expansion and contraction movement.

E. Laying Pipe In Trench:
   1. Excavate and backfill trench in accordance with Specification Section 02221.
   2. Clean each pipe length thoroughly and inspect for compliance to specifications.
   3. Grade trench bottom and excavate for pipe bell and lay pipe on trench bottom.
   4. Install gasket or joint material according to manufacturer's directions after joints have been thoroughly cleaned and examined.
   5. Except for first two (2) joints, before making final connections of joints, install two (2) full sections of pipe with earth tamped along side of pipe or final with bedding material placed.
   6. Lay pipe in only suitable weather with good trench conditions.
      a. Never lay pipe in water except where approved by Engineer.
   7. Seal open end of line with watertight plug if pipe laying stopped.
1. Lining Up Push-On Joint Piping:
   a. Lay piping on route lines shown on Drawings.
   b. Deflect from straight alignments or grades by vertical or horizontal curves or offsets.
   c. Observe maximum deflection values stated in manufacturer's written literature.
   d. Provide special bends when specified or where required alignment exceeds allowable
deflections stipulated.
   e. Install shorter lengths of pipe in such length and number that angular deflection of any joint,
as represented by specified maximum deflection, is not exceeded.

2. Anchorage and Blocking:
   a. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for
   preventing movement of piping caused by forces in or on buried piping tees, wye branches,
   plugs, or bends.
   b. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall.
   c. Concrete blocks shall not cover pipe joints.
   d. Provide bearing area of concrete in accordance with drawing detail.

3. Install underground hazard warning tape per Specification Section 10400.

4. Install insulating components where dissimilar metals are joined together.

3.2 INTERIOR AND EXPOSED EXTERIOR PIPING INSTALLATION

A. Install piping in vertical and horizontal alignment as shown on Drawings.

B. Alignment of piping smaller than 4 IN may not be shown; however, install according to Drawing
   intent and with clearance and allowance for:
   1. Expansion and contraction.
   2. Operation and access to equipment, doors, windows, hoists, moving equipment.
   3. Headroom and walking space for working areas and aisles.
   4. System drainage and air removal.

C. Enter and exit through structure walls, floor and ceilings using penetrations and seals specified
   in Specification Section 01800 and as shown on the Drawings.

D. Install vertical piping runs plumb and horizontal piping runs parallel with structure walls.

E. Pipe Support:
   1. Use methods of piping support as shown on Drawings and as required in Specification
      Section 15090.
   2. Where pipes run parallel and at same elevation or grade, they may be grouped and
      supported from common trapeze-type hanger, provided hanger rods are increased in size as
      specified for total supported weight.
      a. The pipe in the group requiring the least maximum distance between supports shall set
         the distance between trapeze hangers.
   3. Size pipe supports with consideration to specific gravity of liquid being piped.

F. Locate and size sleeves and castings required for piping system.
   1. Arrange for chases, recesses, inserts or anchors at proper elevation and location.

G. Use reducing fittings throughout piping systems.
   1. Bushings will not be allowed unless specifically approved.

H. Equipment Drainage and Miscellaneous Piping:
   1. Provide drip pans and piping at equipment where condensation may occur.
   2. Hard pipe stuffing box leakage to nearest floor drain.
   3. Avoid piping over electrical components such as motor control centers, panelboards, etc.
      a. If piping must be so routed, utilize 16 GA, 316 stainless steel drip pan under piping and
         over full length of electrical equipment.
      b. Hard pipe drainage to nearest floor drain.
   4. Collect system condensate at drip pockets, traps and blowoff valves.
5. Provide drainage for process piping at locations shown on Drawings in accordance with Drawing details.

6. For applications defined above and for other miscellaneous piping which is not addressed by a specific piping service category in PART 1, provide 304 stainless steel piping and fittings.
   a. Size to handle application with 3/4 IN being minimum size provided.

I. Unions:
   1. Install in position which will permit valve or equipment to be removed without dismantling adjacent piping.
   2. Mechanical type couplings may serve as unions.
   3. Additional flange unions are not required at flanged connections.

J. Install expansion devices as necessary to allow expansion/contraction movement.

K. Provide full face gaskets on all systems.

L. Anchorage and Blocking:
   1. Block, anchor, or harness exposed piping subjected to forces in which joints are installed to prevent separation of joints and transmission of stress into equipment or structural components not designed to resist those stresses.

M. Equipment Pipe Connections:
   1. Equipment - General:
      a. Exercise care in bolting flanged joints so that there is no restraint on the opposite end of pipe or fitting which would prevent uniform gasket pressure at connection or would cause unnecessary stresses to be transmitted to equipment flanges.
      b. Where push-on joints are used in conjunction with flanged joints, final positioning of push-on joints shall not be made until flange joints have been tightened without strain.
      c. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint.
         1) Provide tightening torque in accordance with manufacturer's recommendations.
      d. Support and match flange faces to uniform contact over their entire face area prior to installation of any bolt between the piping flange and equipment connecting flange.
      e. Permit piping connected to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.
      f. Align, level, and wedge equipment into place during fitting and alignment of connecting piping.
      g. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.
         h. To provide maximum flexibility and ease of alignment, assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened.
            1) Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
            2) Realign as necessary, install flange bolts and make equipment connection.
      i. Provide utility connections to equipment shown on Drawings, scheduled or specified.
   2. Plumbing and HVAC equipment:
      a. Make piping connections to plumbing and HVAC equipment, including but not limited to installation of fittings, strainers, pressure reducing valves, flow control valves and relief valves provided with or as integral part of equipment.
      b. Furnish and install sinks, fittings, strainers, pressure reducing valves, flow control valves, pressure relief valves, and shock absorbers which are not specified to be provided with or as integral part of equipment.
      c. For each water supply piping connection to equipment, furnish and install union and gate or angle valve.
         1) Provide wheel handle stop valve at each laboratory sink water supply.
         2) Minimum size: 1/2 IN.
d. Furnish and install "P" trap for each waste piping connection to equipment if waste is
c connected directly to building sewer system.
  1) Size trap as required by IPC.
e. Stub piping for equipment, sinks, lavatories, supply and drain fittings, key stops, "P"
  traps, miscellaneous traps and miscellaneous brass through wall or floor and cap and
  protect until such time when later installation is performed.

N. Provide insulating components where dissimilar metals are joined together.
O. Instrument Connections: See Drawing details.

3.3 CONNECTIONS WITH EXISTING PIPING
A. Where connection between new work and existing work is made, use suitable and proper fittings
  to suit conditions encountered.
B. Perform connections with existing piping at time and under conditions which will least interfere
  with service to customers affected by such operation.
C. Undertake connections in fashion which will disturb system as little as possible.
D. Provide suitable equipment and facilities to dewater, drain, and dispose of liquid removed
  without damage to adjacent property.
E. Where connections to existing systems necessitate employment of past installation methods not
  currently part of trade practice, utilize necessary special piping components.
F. Where connection involves potable water systems, provide disinfection methods as prescribed in
  this Specification Section.
G. Once tie-in to each existing system is initiated, continue work continuously until tie-in is made
  and tested.

3.4 ACCESS PROVISIONS
A. Provide access doors or panels in walls, floors, and ceilings to permit access to valves, piping
  and piping appurtenances requiring service.
B. Size of access panels to allow inspection and removal of items served, minimum 10 x 14 IN size.
C. Fabricate door and frame of minimum 14 GA, stretcher leveled stock, cadmium plated or
  galvanized after fabrication and fitted with screw driver lock of cam type.
D. Provide with key locks, keyed alike, in public use areas.
E. Furnish panels with prime coat of paint.
F. Style and type as required for material in which door installed.
G. Where door is installed in fire-rated construction, provide door bearing UL label required for
  condition.

3.5 CATHODIC PROTECTION
A. Isolate, dielectrically, all piping from all other metals including reinforcing bars in concrete
  slabs, other pipe lines, and miscellaneous metal.
B. Make all connections from wire or cable by Thermit Cadwelding accomplished by operators
  experienced in this process.
C. Install all cables with a loop and overhead knot around each pipe and slack equal to at least 50
  percent of the straight line length.
D. After cadwelding, coat all exposed metallic surfaces with hot applied tape.
3.6 HEAT TRACING

A. See Specification Section 16125 - Heat Tracing Cable.

3.7 PRESSURE GAGES

A. Provide at locations shown on the Drawings and specified.

B. See Specification Section 11005.

3.8 FIELD QUALITY CONTROL

A. Pipe Testing - General:

1. Test piping systems as follows:
   a. Test exposed, non-insulated piping systems upon completion of system.
   b. Test exposed, insulated piping systems upon completion of system but prior to
      application of insulation.
   c. Test concealed interior piping systems prior to concealment and, if system is insulated,
      prior to application of insulation.
   d. Test buried piping (insulated and non-insulated) prior to backfilling and, if insulated,
      prior to application of insulation.

2. Utilize pressures, media and pressure test durations as specified in the PIPING
   SPECIFICATION SCHEDULES.

3. Isolate equipment which may be damaged by the specified pressure test conditions.

4. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring
   equipment to determine leakage rates.
   a. Select each gage so that the specified test pressure falls within the upper half of the
      gage's range.
   b. Notify the Engineer 24 HRS prior to each test.

5. Completely assemble and test new piping systems prior to connection to existing pipe
   systems.

6. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior
   to final acceptance.

7. Bear the cost of all testing and inspecting, locating and remedying of leaks and any
   necessary retesting and re-examination.

B. Pressure Testing:

1. Testing medium: Unless otherwise specified in the PIPING SPECIFICATION
   SCHEDULES, utilize the following test media.
   a. Process and plant air systems:

      | PIPE LINE SIZE | SPECIFIED TEST PRESSURE | TESTING MEDIUM |
      |----------------|-------------------------|---------------|
      | 2 IN and smaller | 75 psi or less          | Air or water  |
      | 2 IN and smaller | Greater than 75 psi     | Water         |
      | Greater than 2 IN | 3 psi or less           | Air or water  |
      | Greater than 2 IN | Greater than 3 psi      | Water         |

   b. Laboratory gases and natural gas systems: Cylinder nitrogen.
   c. Liquid systems:

      | PIPE LINE SIZE (DIA) | GRAVITY OR PUMPED | SPECIFIED TEST PRESSURE | TESTING MEDIUM |
      |----------------------|-------------------|-------------------------|---------------|
      | Up to and including 48 IN | Gravity          | 25 psig or less        | Air or water  |
      | Above 48 IN           | Gravity          | 25 psig or less        | Water         |
      | All sizes             | Pumped           | 250 psig or less       | Water         |
2. Allowable leakage rates:
   a. Hazardous gas systems, all exposed piping systems, all pressure piping systems and all
      buried, insulated piping systems which are hydrostatically pressure tested shall have
      zero leakage at the specified test pressure throughout the duration of the test.
   b. Hydrostatic exfiltration and infiltration for sanitary and stormwater sewers
      (groundwater level is below the top of pipe):
         1) Leakage rate: 200 GAL per inch diameter per mile of pipe per day at average head
            on test section of 3 FT.
         2) Average head is defined from groundwater elevation to average pipe crown.
         3) Acceptable test head leakage rate for heads greater than 3 FT: Acceptable leakage
            rate (gallons per inch diameter per mile per day) equals 115 by (actual test head to
            the 1/2 power).
   c. Hydrostatic infiltration test for sanitary and stormwater sewers (groundwater level is
      above the top of pipe):
      1) Allowable leakage rate: 200 GAL per inch diameter per mile of pipe per day when
         depth of groundwater over top of pipe is 2 to 6 FT.
      2) Leakage rate at heads greater than 6 FT: Allowable leakage rate (gallons per inch
         diameter per mile of pipe per day) equals 82 by (actual head to the 1/2 power).
   d. Large diameter (above 48 IN) gravity plant piping systems shall have a maximum
      exfiltration of 25 gpd per inch-mile.
   e. Non-hazardous gas and air systems which are tested with air shall have a maximum
      pressure drop of 5 percent of the specified test pressure throughout the duration of the
      test.
   f. For low pressure (less than 25 psig) air testing, the acceptable time for loss of 1 psig of
      air pressure shall be:

<table>
<thead>
<tr>
<th>PIPE SIZE (IN DIA)</th>
<th>TIME, MINUTES/100 FT</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0.3</td>
</tr>
<tr>
<td>6</td>
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<td>7.3</td>
</tr>
<tr>
<td>48</td>
<td>7.6</td>
</tr>
</tbody>
</table>

3. Hydrostatic pressure testing methodology:
   a. General:
      1) All joints, including welds, are to be left exposed for examination during the test.
      2) Provide additional temporary supports for piping systems designed for vapor or gas
         to support the weight of the test water.
      3) Provide temporary restraints for expansion joints for additional pressure load under
         test.
      4) Isolate equipment in piping system with rated pressure lower than pipe test
         pressure.
      5) Do not paint or insulate exposed piping until successful performance of pressure
         test.
b. Soil, waste, drain and vent systems:
   1) Test at completion of installation of each stack or section of piping by filling
      system with water and checking joints and fittings for leaks.
   2) Eliminate leaks before proceeding with work or concealing piping.
   3) Minimum test heights shall be 10 FT above highest stack inlet.

c. Larger diameter (above 36 IN) gravity plant piping:
   1) Plug downstream end of segment to be tested.
      a) Provide bracing as required.
   2) Fill segment and upstream structure to normal operating level as per hydraulic
      profile.
   3) Allow 24 HRS for absorption losses.
      a) Refill to original level.
   4) Provide reservoir to maintain constant head over duration of test.
   5) Record reservoir water volume at beginning and end of test.

4. Natural gas systems - testing methodology:
   a. Maintain specified test pressure until each joint has been thoroughly examined for leaks
      by means of soap suds and glycerine.
   b. Wipe joints clean after test.

5. Air testing methodology:
   a. General:
   1) Assure air is ambient temperature.
   b. Low pressure air testing:
   1) Place plugs in line and inflate to 25 psig.
   2) Check pneumatic plugs for proper sealing.
   3) Introduce low pressure air into sealed line segment until air pressure reaches 4 psig
      greater than ground water that may be over the pipe.
      a) Use test gage conforming to ASME B40.100 with 0 to 15 psi scale and
      accuracy of 1 percent of full range.
   4) Allow 2 minutes for air pressure to stabilize.
   5) After stabilization period (3.5 psig minimum pressure in pipe) discontinue air
      supply to line segment.
   6) Record pressure at beginning and end of test.

C. Dielectric Testing Methods and Criteria:
   1. Provide electrical check between metallic non-ferrous pipe or appurtenances and ferrous
      elements of construction to assure discontinuity has been maintained.
   2. Wherever electrical contact is demonstrated by such test, locate the point or points of
      continuity and correct the condition.

3.9 CLEANING, DISINFECTION AND PURGING

A. Cleaning:
   1. Clean interior of piping systems thoroughly before installing.
   2. Maintain pipe in clean condition during installation.
   3. Before jointing piping, thoroughly clean and wipe joint contact surfaces and then properly
      dress and make joint.
   4. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other
      foreign materials which may have entered the system.
   5. At completion of work and prior to Final Acceptance, thoroughly clean work installed under
      these Specifications.
      a. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and
      sludge which may have accumulated by operation of system, from testing, or from
      other causes.
      b. Repair any stoppage or discoloration or other damage to parts of building, its finish, or
      furnishings, due to failure to properly clean piping system, without cost to Owner.
6. After erection of piping and tubing, but prior to installation of service outlet valves, blow natural gas systems clear of free moisture and foreign matter by means of air, nitrogen or carbon dioxide.
   a. Oxygen shall never be used.
7. Clean chlorine piping in accordance with CI Pamphlet 6.
8. Purge all neat liquid polymer tubing or piping between the neat polymer storage tank or tote and the polymer blending units with mineral oil to remove residual water prior to introducing neat polymer. Following purging, drain as much of the mineral oil out of the system as possible. Dispose of purged fluids and waste mineral oil in accordance with local environmental regulations.

B. Disinfection of Potable Water Systems:
1. After favorable performance of pressure test and prior to Final Acceptance, thoroughly flush entire potable water piping system including supply, source and any appurtenant devices and perform disinfection as prescribed.
2. Perform work, including preventative measures during construction, in full compliance with AWWA C651.
3. Perform disinfection using sodium hypochlorite complying with AWWA B300.
4. Flush each segment of system to provide flushing velocity of not less than 2.5 FT per second.
5. Drain flushing water to sanitary sewer.
   a. Do not drain flushing water to receiving stream.
6. Use continuous feed method of application.
   a. Tag system during disinfection procedure to prevent use.
7. After required contact period, flush system to remove traces of heavily chlorinated water.
8. After final flushing and before placing water in service, obtain an independent laboratory approved by the Owner to collect samples and test for bacteriological quality.
   a. Repeat entire disinfection procedures until satisfactory results are obtained.
9. Secure and deliver to Owner, satisfactory bacteriological reports on samples taken from system.
   a. Ensure sampling and testing procedures are in full compliance to AWWA C651, local water purveyor and applicable requirements of State of South Dakota.

C. Purging Natural Gas:
1. Existing piping:
   a. Turn off gas supply.
   b. Vent line pressure outdoors.
   c. If section exceeds the following, then remaining gas shall be displaced with an inert gas.
      1) 50 FT for 2-1/2 IN pipe.
      2) 30 FT for 3 IN pipe.
      3) 15 FT for 4 IN pipe.
      4) 10 FT for 6 IN pipe.
      5) Any length for 8 IN or larger pipe.
2. New piping:
   a. Including but not limited to: All fuel gas piping.
3. Discharge of purged gases:
   a. Open end of piping shall not discharge into confined spaces or areas where there are sources of ignition.

3.10 LOCATION OF BURIED OBSTACLES

A. Furnish exact location and description of buried utilities encountered and thrust block placement.
B. Reference items to definitive reference point locations such as found property corners, entrances to buildings, existing structure lines, fire hydrants and related fixed structures.
C. Include such information as location, elevation, coverage, supports and additional pertinent information.

D. Incorporate information on "As-Recorded" Drawings.

3.11 PIPE INSULATION

A. Insulate pipe and pipe fittings in accordance with Specification Section 15183.

3.12 SCHEDULES
A. SPECIFICATION SCHEDULE - SYSTEM 5

1. General:
   a. Piping symbol and service:
      1) NG - Natural Gas.
   b. Test requirements:
      1) Test medium: Cylinder Nitrogen.
      2) Pressure: 1 psig.
      3) Duration: 6 HRS.

2. System components:
   a. Pipe size through 26 IN:
      1) Exposed service:
         a) Material: Steel, Grade B, black, Schedule 40.
         b) Reference: ASTM A53.
         c) Lining: None.
         d) Coating: Paint.
         e) Fittings: Malleable iron meeting ASTM A197, ASME B16.3, Class 150.
         f) Joints: Threaded, ASME B16.9 steel butt- or socket-welded joints.
      2) Buried service:
         a) Materials: High density polyethylene (HDPE).
         c) Lining: None.
         d) Coatings: None.
         e) Fittings: Socket fusion or butt fusion fittings complying with ASTM D2683
            and ASTM D3261.
         f) Joints: Fusion jointing system or as directed by local gas company.

Natural Gas Piping Installation:
1. Install piping in accordance with NFPA, local gas company regulations, codes and local
   ordinances, complete with necessary appurtenances.
2. Install buried pipe at approximately 30 IN deep.
3. Gas cocks:
   a. Install before gas utilization equipment connected to system, at each branch main and at
      connection to meter.
   b. Design to operate safely under pressures indicated.
   c. Install ground joint unions at intervals to facilitate repairs.
   d. Cocks shall be of type and lubricant recommended by manufacturer for this class of
      service, and as approved by local gas company.
4. Pipe drainage:
   a. Drain horizontal piping to risers.
   b. Locate drains where required for system drainage.
   c. Install tee fitting with bottom outlet plugged or provide with threaded, capped nipple at
      bottom of risers or in accordance with applicable codes.
5. Make piping connections with shellacked joints or ground joint unions.
6. Provide vents from gas regulators, pressure reducing valves, and other vented devices to the
   outdoors and terminate in accordance with applicable codes.
7. Connect piping to pressure reducing valve outside each building as shown on drawings and
   schedule.
8. Provide flexible connections to vibration isolated equipment suitable for pressures, local and
   national codes and intended application.
9. Remove cutting and threading burrs.
10. Plug each gas outlet (including valves) with threaded plugs or caps immediately after
    installation and retain until the piping or equipment connections are completed.
11. Continuously ground gas piping electrically, bond tightly to the grounding connection.
12. Install piping parallel to other piping, but maintain a minimum 12 IN clearance between gas
    piping and any piping that could reach 200 DegF.
13. All gas piping in air plenums to be all-welded and encased in a Schedule 40 pipe sleeve.
   a. Ends of the sleeve open to atmosphere or sealed with the annulus vented (gas pipe
      size) to atmosphere.
B. SPECIFICATION SCHEDULE - SYSTEM 8

1. General:
   a. Piping symbol and service:
      1) SH - Sodium Hydroxide.
   b. Test requirements:
      1) Test medium: Water.
      2) Pressure: 125 psig.
      3) Duration: 6 HRS.
   c. Gaskets and O-rings: Polypropylene.

2. System components:
   a. Pipe size 12 IN and smaller:
      1) Buried service inside casing pipe:
         a) Tubing:
            (1) Nylorbrade or approved equal.
            (2) Material: PVC.
            (3) Lining: None.
            (4) Coating: None.
            (5) Joints: CPVC barb fittings secured with 316 stainless steel hose clamps.
            (6) Minimum wall thickness: 0.188 IN.
            (7) Pressure rating: 233 PSI.
            (8) Shore hardness: 80A.
      2) Exposed service:
         a) Hard piping:
            (1) Material: CPVC, Schedule 80.
            (2) Reference: ASTM F441.
            (3) Lining: None.
            (4) Coating: None.
            (5) Fittings: Solvent welded socket type complying with ASTM F439.
            (6) Joints:
               (a) Solvent welded with unions at valves, penetrations through structures and equipment connections for pipe 2 IN and less and flanges at those locations for pipe above 2 IN.
               (b) For sodium hydroxide, provide pipe joint primer IPS-70 and pipe joint solvent cement IPS-724.
         b) Flexible suction tubing:
            (1) Material: PVC.
            (2) Lining: None.
            (3) Coating: None.
            (4) Joints: CPVC barb fittings secured with 316 stainless steel hose clamps.
            (5) Minimum wall thickness: 0.188 IN.
            (6) Pressure rating: 233 PSI.
            (7) Shore hardness: 80A.
         c) Wall penetration at the chemical unloading station:
            (1) Material: Fiberglass reinforced plastic pipe (FRP).
            (a) Compatable with chemical.
            (2) Reference: filament wound using amine-cured epoxy resin and fiberglass.
            (3) Lining: None.
            (4) Coating: None.
            (5) Fittings: Epoxy resin and fiberglass.
            (6) Joints: Flanged.
            (7) Minimum wall thickness: 0.33 IN.
C. SPECIFICATION SCHEDULE - SYSTEM 9

1. General:
   a. Piping symbol and service:
      1) SUP - Sump.
      2) CP - Casing Pipe.
   b. Test requirements:
      1) Test medium: Water.
      2) Pressure: 125 psig.
      3) Duration: 6 HRS.
   c. Gaskets and O-rings:
      1) O-rings: Neoprene or rubber.

2. System components:
   a. Pipe size 1 IN to 4 IN:
      1) Exposed service:
         a) Materials: PVC, Type 1, Grade 1, Schedule 80.
         b) Reference: ASM D1785.
         c) Lining: None.
         d) Coating: None.
         e) Fittings: Solvent weld (compatable solvent) socket type complying with
            ASTM D1785.
         f) Joints: Solvent weld (compatable solvent) with unions at valves, penetrations
            through structures and equipment connections.
      2) Buried service:
         a) Materials: PVC, Type 1, Grade 1, Schedule 80.
         b) Reference: ASM D1785.
         c) Lining: None.
         d) Coating: None.
         e) Fittings: Solvent weld (compatable solvent) socket type complying with
            ASTM D2466.
         f) Joints: Solvent weld (compatable solvent) with unions at valves, penetrations
            through structures and equipment connections.
D. SPECIFICATION SCHEDULE - SYSTEM 10

1. General:
   a. Piping symbol and service:
      1) PWH - Potable Water Hot.
   b. Test requirements:
      1) Test medium: Water.
      2) Pressure: 150 psig.
      3) Duration: 6 HRS.
   c. Gaskets and O-rings:
      1) O-rings: Neoprene or rubber.
      2) Flanged, push-on and mechanical joints (ductile iron): Rubber, AWWA/ANSI C111/A21.11.
      3) Flanged joints (steel): Rubber, AWWA C207.
      4) Grooved coupling joints (ductile and steel): Rubber, AWWA C606.

2. System components:
   a. Pipe size to 3 IN:
      1) Exposed service:
         a) Material: Copper tubing, Type L.
         b) Solder: Cadmium and lead-free solder compatible with tubing and fittings materials.
         c) Reference: ASTM B88.
         d) Lining: None.
         e) Coating: Paint.
         f) Fittings: Wrought copper or bronze fittings meeting ASME B16.22.
         g) Joints: Soldered or brazed with unions at valves and equipment.

3. Install drain tees with capped nipples of IPS brass 3 IN long at low points.
   a. If low point occurs in concealed piping, provide approved flush access panel.
   b. These drains are not shown on Drawings.

4. Slope water lines down to drain points not less than 1 IN in 60 FT.

5. Install all threaded piping with clean-cut tapered threads and with ends thoroughly reamed after cutting to remove burrs.
   a. Pipe joint cement permitted only on external threads.

6. For screwed nipples for connections to flush valves, lavatory supplies, and other equipment with threaded connections use iron, copper, or brass pipe.

7. Install ball, butterfly and plug valves where indicated or required to adequately service all parts of system and equipment.
   a. Install valves on each branch serving restroom.
   b. Install valves on inlet and outlet connections of heat exchangers and on other equipment connected to water lines.

8. Install unions between valves and connections to each piece of equipment, and install sufficient number of unions throughout piping system to facilitate installation and servicing.
   a. On copper pipe lines, install wrought, solder-joint, copper to copper unions for lines 2 IN and smaller and, for lines 2-1/2 IN and over install brass flange unions.

9. Construct and equip plumbing fixtures and equipment with anti-siphon devices as to entirely eliminate any danger of siphoning waste material into potable water supply system.

10. Where exposed pipes 6 IN in size and smaller pass through floors, finished walls, or finished ceilings, fit with nickel or chrome-plated plates large enough to completely close hole around pipes.
    a. Secure plates to pipe by set screw in approved manner.

11. Size supply branches to individual fixtures as scheduled or indicated on Drawings.

12. Install piping so as to be free to expand with proper loops, anchors and joints without injury to system or structure.

13. Provide branches to wall hydrants or hose bibbs in exterior locations with interior shutoff and drain valves.
14. Provide approved type vacuum breaker and backflow preventer installations indicated or as required by Code.

15. Install concealed in finished structures such as administration and office facilities and at locations shown on Drawings.
E. SPECIFICATION SCHEDULE - SYSTEM 27

1. General:
   a. Piping symbol and service:
      1) PWC - Potable Water – Cold.
      2) TW - Tempered Water.
   b. Test requirements pressure lines:
      1) Test medium: Water.
      2) Pressure: 100 psig.
      3) Duration: 6 HRS.
   c. Gaskets and O-rings:
      1) O-rings and flanged joints: Neoprene or rubber.

2. System components:
   a. Pipe size 12 IN and smaller:
      1) Exposed service:
         a) Material: PVC, Type 1, Grade 1, Schedule 80.
         c) Lining: None.
         d) Coating: Paint.
         e) Fittings: Solvent welded socket type complying with ASTM D2467.
         f) Joints: Solvent welded with unions at valves, penetrations through structures and equipment connections for pipe 2 IN and less and flanges at those locations for pipe above 2 IN.
      2) Buried service:
         a) Material: PVC, Type 1, Grade 1, Schedule 40.
         c) Lining: None.
         d) Coating: None.
         e) Fittings: Solvent welded socket type complying with ASTM D2466.
         f) Joints: Solvent welded.

3. Install drain tees with capped nipples of IPS brass 3 IN long at low points.
   a. If low point occurs in concealed piping, provide approved flush access panel.
   b. These drains are not shown on Drawings.

4. Slope water lines down to drain points not less than 1 IN in 60 FT.

5. Install all threaded piping with clean-cut tapered threads and with ends thoroughly reamed after cutting to remove burrs.
   a. Pipe joint cement permitted only on external threads.

6. For screwed nipples for connections to flush valves, lavatory supplies, and other equipment with threaded connections use iron, copper, or brass pipe.

7. Install ball, butterfly and plug valves where indicated or required to adequately service all parts of system and equipment.
   a. Install valves on each branch serving restroom.
   b. Install valves on inlet and outlet connections of heat exchangers and on other equipment connected to water lines.

8. Install unions between valves and connections to each piece of equipment, and install sufficient number of unions throughout piping system to facilitate installation and servicing.
   a. On copper pipe lines, install wrought, solder-joint, copper to copper unions for lines 2 IN and smaller and, for lines 2-1/2 IN and over install brass flange unions.

9. Construct and equip plumbing fixtures and equipment with anti-siphon devices as to entirely eliminate any danger of siphoning waste material into potable water supply system.

10. Where exposed pipes 6 IN in size and smaller pass through floors, finished walls, or finished ceilings, fit with nickel or chrome-plated plates large enough to completely close hole around pipes.
    a. Secure plates to pipe by set screw in approved manner.

11. Size supply branches to individual fixtures as scheduled or indicated on Drawings.
12. Install piping so as to be free to expand with proper loops, anchors and joints without injury to system or structure.

13. Provide branches to wall hydrants or hose bibbs in exterior locations with interior shutoff and drain valves.

14. Provide approved type vacuum breaker and backflow preventer installations indicated or as required by Code.

15. Install concealed in finished structures such as administration and office facilities and at locations shown on Drawings.

END OF SECTION
SECTION 15061
PIPE: STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel pipe, fittings, and appurtenances.

B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 09905 - Painting and Protective Coatings.
   4. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
      e. B16.9, Factory-Made Wrought Steel Butt-Welding Fittings.
      f. B16.11, Forged Steel Fittings, Socket Welding and Threaded.
      g. B31.1, Power Piping.
      i. B31.9, Building Services Piping.
      j. Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
   2. ASTM International (ASTM):
      g. A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
   3. American Water Works Association (AWWA):
      a. C200, Standard for Steel Water Pipe - 6 IN and Larger.
d. C206, Standard for Field Welding of Steel Water Pipe.
e. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.
g. C209, Standard for Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
h. C210, Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
i. C606, Standard for Grooved and Shouldered Joints.

4. Society of Automotive Engineers (SAE):
a. AMS-QQ-P-416, Cadmium Plating Electro deposited.

B. Qualifications:
1. Application of lining and coating materials including preparation of surfaces, priming, and lining and coating of pipe, fittings, and specials, in shop, repairs of any damage to lining or coating occurring during shipment or any other time, and field lining and coating of ends where linings or coatings have been held back for welded field joints, shall be done by established and recognized pipe company acceptable to Engineer.
2. Use only certified welders meeting procedures and performance outlined in ASME Section IX, AWWA C200 Section 3.3.3 and other codes and requirements per local building and utility requirements.

1.3 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
2. See Specification Section 15060.
3. Factory test reports.
4. If mechanical grooved type coupling system is used, submit piping, fittings, and appurtenant items which will be utilized.
5. Coating manufacturer's qualifications.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Flanged adaptors:
   a. Rockwell (Style 912 (cast)).
   b. Dresser (Style 127 (cast)).
2. Insulating couplings:
   a. Rockwell (Style 416).
   b. Dresser (Style 39).
3. Reducing couplings:
   a. Rockwell (Style 415).
   b. Dresser (Style 62).
4. Transition coupling:
   a. Rockwell (Style 413).
   b. Dresser (Style 62).
5. Compression sleeve coupling:
   a. Rockwell (Style 431 (cast)).
   b. Dresser (Style 53 (cast)).

6. Mechanical couplings and fittings:
   a. Victaulic (Style 07 or 77).
   b. S.P. Fittings.

7. Vibration isolation equipment connections for natural gas:
   a. Flexonics (Model 401H).

8. Flexible connectors for hot water equipment:
   a. Flexonics (FLG Series).

9. Factory-applied plastic or epoxy coatings:
   a. "Encoat" Division of Energy Coating Company.
   b. "Scotchkote" Division of 3M Company.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. All materials used in steel piping systems defined in Section 15060 shall meet or exceed
   pressure test requirements specified for each respective system.

B. Steel Pipe (Fabricated Type):
   1. AWWA C200:
      a. ASTM A36, Grade C steel plate.
      b. ASTM A283, Grade D steel plate.
      c. ASTM A572, steel plate.
      d. ASTM A1011, steel sheet.

C. Steel Pipe (Mill Type): ASTM A53, Type E or S.

D. Fittings (For Fabricated Pipe): AWWA C208.

E. Fittings (For Mill Type Pipe):
   1. ASTM A234.

F. Flanges (Fabricated Pipe):
   1. Flange material: ASTM A283, Grade C or D, ASTM A181, Grade 1.
   2. Flange finish: Flat faced.

G. Flanges (Mill Type Pipe):
   1. ASME B16.5.
   2. Flat faced.

H. Nuts and Bolts:
   1. Buried: Cadmium-plated meeting SAE AMS-QQ-P-416, Type 1, Class 2 (Cor-Ten) for
      buried application.
   2. Exposed: Mechanical galvanized ASTM B695, Class 40.
   3. Heads and dimensions per ASME B1.1.
   5. Project ends 1/4 to 1/2 IN beyond nuts.

I. Gaskets: See individual piping systems in Section 15060.

2.3 MANUFACTURED UNITS

A. Couplings:
   1. Flanged adaptors:
      a. Steel or carbon steel body sleeve, flange, followers and Grade 30 rubber gaskets.
b. Provide units specified in Article 2.1.
c. Flanges meeting standards of adjoining flanges.
d. Entire assembly to be rated for test pressure specified on Piping Schedule for each respective application.

2. Compression sleeve coupling:
   a. Steel sleeve, followers Grade 30 and rubber gaskets.
b. Provide units specified in Article 2.1.
c. Flanges meeting standards of adjoining flanges.
d. Entire assembly to be rated for test pressure specified on Piping Schedule for each respective application.
e. Provide field coating for buried couplings per AWWA C203.

3. Mechanical coupling joint:
   a. Use of mechanical grooved (AWWA C606) type couplings and fittings in lieu of flanged joints is acceptable where specifically specified in Section 15060.
b. Utilize units defined in Article 2.1.

2.4 ACCESSORIES
A. Heating Water Application:
   1. For steel heating lines, provide braided, flanged stainless steel connectors for connection to equipment.
   2. Provide pump connectors with stainless steel construction, rubber filled bellows and flanged end connections.
B. Natural Gas Equipment Isolator: 316L stainless steel, T-321 stainless steel braid with connections compatible with joints in piping system.

2.5 FABRICATION
A. Provide piping (mill or fabricated) for use in this Project with minimum wall thicknesses as follows:
   1. 1/8 - 5 IN DIA pipe: Schedule 40.
   2. 6 - 10 IN DIA pipe: 3/16 IN.
   3. 12 - 14 IN DIA pipe: 7/32 IN.
   4. 16 - 48 IN DIA pipe: 1/4 IN.
   5. 54 - 60 IN DIA pipe: 5/16 IN.
   6. 66 - 72 IN DIA pipe: 3/8 IN.
   7. Sizes through 24 IN are nominal OD.
      a. Sizes greater than 24 are ID.
   8. Wall thicknesses indicated are for standard weight pipe.
      a. Design pipe in accordance with operating pressures shown in Piping Schedules for a design stress limited to 50 percent of yield.
B. Furnish cast parts with lacquer finish compatible with finish coating.
C. Furnish without outside coating of bituminous material any exposed pipe scheduled to be painted.
D. Fabricated Fittings:
   1. AWWA C208.
   2. Assure ratio of radius of bend to diameter of pipe equal to or greater than 1.0.
E. Taper cement mortar linings as required for valve interfacing.
F. Protective Coatings and Linings:
   1. Provide enamel linings and coatings in accordance with AWWA C203 and the following:
      a. Potable water: Provide minimum dry film of 5 mils of asphaltic coating non-toxic blend of Gilsonite and brown and steam distilled asphalt.
      b. Nonpotable fluids: Provide minimum dry film of 5 mils of acceptable asphalt base material.
c. Provide coating in accordance with AWWA C203 and subject to following additional requirements.
   1) Do not use enamel lined or coated steel pipe exposed to temperatures below 10 DegF.
   2) Do not handle enamel-lined or coated pipe when temperature of pipe is below 20 DegF.

2. Provide cement mortar lining in accordance with AWWA C205.
3. Provide cement mortar coating in accordance with AWWA C205.
5. Wrap pipe in accordance with AWWA C209.
6. Field paint pipe in accordance with Section 09905.

2.6 SOURCE QUALITY CONTROL

A. Testing:
   1. Shop hydrostatic test fabricated steel pipe and fittings.
   2. Field hydrostatic test all pipe as specified in Section 15060.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Joining Methods - Flanges:
   1. Facing method:
      a. Insert slip-on flange on pipe.
      b. Assure maximum tolerances for flange faces from normal with respect to axis of pipe is 0.005 IN per foot of flange diameter.
      c. Test flanges after welding to pipe for true to face condition and reface, if necessary, to bring to specified tolerance.
   2. Joining method:
      a. Leave 1/8 to 3/8 IN of flange bolts projecting beyond face of nut after tightening.
      b. Coordinate dimensions and drillings of flanges with flanges for valves, pumps, equipment, tank, and other interconnecting piping systems.
      c. When bolting flange joints, exercise extreme care to assure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or cause unnecessary stress, bending or torsional strains being applied to cast flanges or flanged fittings.
         1) Allow one (1) flange free movement in any direction while bolts are being tightened.
      d. Do not assemble adjoining flexible coupled, mechanical coupled or welded joints until flanged joints in piping system have been tightened.
      e. Gradually tighten flange bolts uniformly to permit even gasket compression.
      f. Do not overstress bolts to compensate for poor installation.
   C. Joining Method - Welded Joints:
      1. Perform welding in accordance with AWWA C206 and this Section.
      2. For flange attachment perform in accordance with AWWA C207.
      3. Have each welding operator affix an assigned symbol to all his welds.
         a. Mark each longitudinal joint at the extent of each operator's welding.
         b. Mark each circumferential joint, nozzle, or other weld into places 180 degrees apart.
      4. Welding for all process piping shall conform with ASME B31.3.
         a. Welding of utility piping 125 psi and less shall be welded per ASME B31.9.
         b. Utility piping above 125 psi shall conform to ASME B31.1.
      5. Provide caps, tees, elbows, reducers, etc., manufactured for welded applications.
6. Weldolets may be used for 5 IN and larger pipe provided all slag is removed from inside the pipe.
7. Weld-in nozzles may be used for branch connections to mains and where approved by Engineer.
8. Use all long radius welding elbows for expansion loops and bends.
9. Use long radius reducing welding elbows 90 degree bends and size changes are required.

D. Joining Method - Couplings:
1. Compression sleeve:
   a. Install coupling to allow space of not less than 1/4 IN but not more than 1 IN.
   b. Provide harnessed joint.
      1) Use joint harness arrangements detailed in AWWA M11.
   c. Design harness assembly with adequate number of tie rods for test pressures indicated in Section 15060 and allow for expansion of pipe.
   d. Provide ends to be joined or fitted with compression sleeve couplings of the plain end type.
   e. Grind smooth welds the length of one (1) coupling on either side of joint to be fitted with any coupling.
   f. Assure that outside diameter and out-of-round tolerances are within limits required by coupling manufacturer.
2. Mechanical coupling:
   a. Arrange piping so that pipe ends are in full contact.
   b. Groove and shoulder ends of piping in accordance with manufacturer's recommendations.
   c. Provide coupling and grooving technique assuring a connection which passes pressure testing requirements.

E. Joining Method - Threaded and Coupled (T/C):
1. Provide T/C end conditions that meet ASME B1.2 requirements.
2. Furnish pipe with factory-made T/C ends.
3. Field cut additional threads full and clean with sharp dies.
4. Leave not more than three (3) pipe threads exposed at each branch connection.
5. Ream ends of pipe after threading and before assembly to remove burrs.
6. Use Teflon thread tape on male thread in mating joints.

F. Support exposed piping in accordance with Section 15060.

G. Install buried piping per Section 15060.

3.2 FIELD QUALITY CONTROL

A. Test piping systems in accordance with Section 15060.

END OF SECTION
SECTION 15063
PIPE: COPPER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Copper piping, fittings, and appurtenances.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   4. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.
   5. Section 15090 - Pipe Support Systems.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      b. B16.23, Cast Bronze Solder Joint Drainage Fittings - DWV.
   2. ASTM International (ASTM):
   3. American Welding Society (AWS):
      a. A5.8M/A5.8, Specification for Filler Metals for Brazing and Brazing Welding.

1.3 SUBMITTALS

A. See Specification Section 01340 for requirements for the mechanics and administration of the
   submittal process.

B. See Specification Section 15060.

1.4 MATERIALS

A. Copper Tubing:
   1. Pressure non-buried: ASTM B88, Type L hard.

B. Copper Pipe: ASTM B42, regular strength.

C. Fittings:

D. Soldering and Brazing:
   1. Non-buried:
      a. ASTM B32 solder with a tin/antimony ratio of 95/5 and non-corrosive flux up to 180
         DegF water temperature.
      b. At 180 DegF and above, use brazing alloy with melting temperature above 1000 DegF
         and suitable flux.

E. See Piping Schedules in Specification Section 15060.

F. Unions: Copper, ground joint.
PART 2 - EXECUTION

2.1 INSTALLATION

A. Comply with Specification Section 15060.

2.2 FIELD QUALITY CONTROL

A. Test piping systems in accordance with Specification Section 15060.

B. Utilize only annealed (soft) type tubing where flared joints are used and drawn temper (hard) type tubing where soldered or brazed joints are used.

C. Support exposed piping in accordance with Specification Section 15060 and Specification Section 15090.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic pipe.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. See Specification Section 15060.

B. Referenced Standards:
   1. ASTM International (ASTM):
      a. PVC (polyvinyl chloride) materials:
         2) D1785, Standard Specification for Poly(Vinyl Chloride) PVC Plastic Pipe, Schedules 40, 80 and 120.
         4) D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
         9) F794, Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
      b. Installation:
   2. American Water Works Association (AWWA):
      a. PVC (polyvinyl chloride) materials:
         1) C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 IN Through 12 IN, for Water Distribution.
         2) C905, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 IN through 48 IN, for Water Transmission and Distribution.
      b. Polyethylene (PE) materials:
         1) C901, Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 IN through 3 IN, for Water Service.
   3. NSF International (NSF).
1.3 SUBMITTALS

A. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.

B. See Specification Section 15060.

PART 2 - PRODUCTS

2.1 PVC PRESSURE PIPING (EXPOSED)

A. General:
1. Provide Schedule 80 pipe with Schedule 80 fittings and appurtenances to locations shown on Drawings.
2. Furnish materials in full compliance to following material specifications:
   a. Manufacture pipe, fittings and appurtenances from polyvinyl chloride (PVC) compound which meets the requirements of Type 1, Grade 1 (12454-B) Polyvinyl Chloride as outlined in ASTM D1784.
   b. Manufacture pipe, fittings and valves from materials that have been tested and approved for conveying potable water by the NSF.

B. Pipe:
1. Furnish pipe meeting requirements of ASTM D1785.
2. Pipe 2 IN and less to be solvent welded.
3. Pipe larger than 2 IN may be either flanged or solvent welded unless shown otherwise on Drawings.

C. Fittings: Provide ASTM D2467 PVC socket type fittings having the same pressure and temperature rating as the pipe.

D. Flanges/Unions:
1. Furnish flanges and unions at locations shown on Drawings.
2. Provide either flanges or unions at valves, penetrations through structures and equipment connections.
3. For pipe larger than 2 IN, provide 150 LB socket type PVC flange.
4. For pipe 2 IN and less, provide socket type PVC union with Buna O-rings.
5. Use flat, full faced natural rubber gaskets at flanged connections.
   a. Furnish heavy hex head bolts, each with one (1) heavy hex nut, ASTM F593 Type 316 stainless steel.
6. Use spacers supplied by pipe manufacturer when mating raised-faced flanges to other flanges.

E. Installation:
1. Field threading PVC will not be permitted.
   a. Perform required threaded connections or attachments by the use of factory molded socket by threaded adapters.
   b. Female adapters are not acceptable.
2. Employ installation and pipe support practices and solvent welding all in compliance to the manufacturer's printed recommendation.
   a. Continuously support PVC piping at liquid operating temperatures in excess of 100 DegF.
   b. For vertical piping, band the pipe at intervals to rigidly support load of twice vertical load.
   c. Support riser clamps on spring hangers.
   d. Do not clamp PVC tightly or restrict movement for expansion and contraction.
2.2 PRESSURE PIPING (UNDERGROUND)

A. Materials: Furnish materials in full compliance with following requirements:
1. 1/2-3 IN: AWWA C901 PE per Table A3, AWWA C901.
2. 4-12 IN: AWWA C900 PVC per Table 2, AWWA C900.
3. Joints for polyethylene pipe shall be fusion type in accordance with AWWA C901.
4. Joints for PVC pipe shall be the elastomeric-gasket type with a pressure rating not less than
pipe pressure rating meeting performance requirements of ASTM D3139.

B. Installation:
1. Field threading of PVC pipe will not be permitted.
2. Perform installation procedures, handling, thrust blocking, connections, and other
appurtenant operations in full compliance to the manufacturer's printed recommendations
and in full observance to plan details when more stringent.

2.3 PVC DRAINAGE, SEWER PIPING AND UNDERGROUND AIR DUCTS

A. Materials:
1. Furnish materials in full compliance to the following material specification.
2. PVC pipe shall be rigid, unplasticized polyvinyl chloride (PVC) made of PVC plastic
having a cell classification of 12454-B or 12454-C as described in specification
ASTM D1784.
3. The requirements of this Specification are intended to provide for pipe and fittings suitable
for non-pressure drainage of wastewater and surface water.
4. Joining systems shall consist of an elastomeric gasket joint meeting requirements of
ASTM D3212.
5. Supply to the Engineer all information and sample of joining method for his evaluation.
a. Only jointing methods acceptable to the Engineer will be permitted.
6. Provide pipe and fittings meeting or exceeding the following requirements:
a. 4-27 IN DIA: ASTM D3034 and ASTM F679, SDR 35.
b. 8-30 IN DIA: ASTM F794.
c. 4-18 IN DIA: ASTM F949.
7. Ensure impact strengths and pipe stiffnesses in full compliance to these Specifications.
B. Installation: Install pipe and fittings in accordance with ASTM D2321 and as recommended by
the manufacturer.
1. Provide for a maximum deflection of not more than 3 percent.
C. Infiltration and Exfiltration:
1. The maximum allowable infiltration measured by test shall not exceed 100 GAL per inch of
pipe diameter per mile per 24 HRS.
2. For exfiltration, all the pipe and fittings shall exceed performance requirements by an air
test procedure as specified in Section 15060.
3. Observe full instructions of the Engineer for carrying of testing procedures.
a. Perform tests only during presence of the Engineer or his authorized representative.
4. Should any test on any section of pipe line disclose either infiltration rates greater than
allowed or disclose air loss rate greater than that permitted, locate and repair the defective
joints or pipes at no cost to Owner and retest until requirements stated are met.
D. Deflection:
1. After backfilling, each section of pipe shall be checked for deflection by pulling a mandrel
through the pipe.
2. Pipe with deflection exceeding 5 percent of the inside diameter shall have backfill removed
and replaced to provide a deflection of less than 5 percent.
3. Any repaired pipe shall be retested.

2.4 PVC TUBING

A. General: Provide nylon tubing with fittings and appurtenances as shown on Drawings.
B. Materials:
   1. Furnish clear outer braided tubing with braid outside the walls.
   2. Have tubing manufactured of nylon with working temperatures from 5 to 180 DegF.
   3. Design tubing with a minimum safety factor of 4 to 1 ratio of burst pressure to working pressure at maximum temperature.
   4. Provide tubing with working pressure of 75 psi at 180 DegF.
   5. Ensure that tubing is self-extinguishing and fire resistant.

C. Fittings:
   1. Install tubing with nylon fittings and connectors.
   2. Use barbed type adapters with stainless steel clamps.
   3. Provide fittings capable of withstanding temperatures from a -70 to 250 DegF.
   4. Ensure fittings have the same pressure and temperature rating as the tubing.

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. Identify each length of pipe clearly at intervals of 5 FT or less.
   1. Include manufacturer's name and trademark.
   2. Nominal size of pipe, appurtenant information regarding polymer cell classification and critical identifications regarding performance specifications and NSF approvals when applicable.

3.2 PRESSURE PIPING (UNDERGROUND)

A. Installation:
   1. Field threading of PVC pipe will not be permitted.
   2. Perform installation procedures, handling, thrust blocking, connections, and other appurtenant operations in full compliance to the manufacturer's printed recommendations and in full observance to plan details when more stringent.

3.3 PVC DRAINAGE, SEWER PIPING AND UNDERGROUND AIR DUCTS

A. Installation: Install pipe and fittings in accordance with ASTM D2321 and as recommended by the manufacturer.
   1. Provide for a maximum deflection of not more than 3 percent.

B. Infiltration and Exfiltration:
   1. The maximum allowable infiltration measured by test shall not exceed 100 GAL per inch of pipe diameter per mile per 24 HRS.
   2. For exfiltration, all the pipe and fittings shall exceed performance requirements by an air test procedure as specified in Section 15060.
   3. Observe full instructions of the Engineer for carrying of testing procedures.
      a. Perform tests only during presence of the Engineer or his authorized representative.
   4. Should any test on any section of pipe line disclose either infiltration rates greater than allowed or disclose air loss rate greater than that permitted, locate and repair the defective joints or pipes at no cost to Owner and retest until requirements stated are met.

C. Deflection:
   1. After backfilling, each section of pipe shall be checked for deflection by pulling a mandrel through the pipe.
   2. Pipe with deflection exceeding 5 percent of the inside diameter shall have backfill removed and replaced to provide a deflection of less than 5 percent.
   3. Any repaired pipe shall be retested.
3.4 PVC TUBING

A. Fittings:
1. Install tubing with nylon fittings and connectors.
2. Use barbed type adapters with stainless steel clamps.
3. Provide fittings capable of withstanding temperatures from a -70 to 250 DegF.
4. Ensure fittings have the same pressure and temperature rating as the tubing.

END OF SECTION
SECTION 15067
PIPE: POLYETHYLENE (HDPE)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Polyethylene pipe.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      h. D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
   2. Society for Protective Coatings (SSPC):
      a. SP 3, Power Tool Cleaning.

1.3 DEFINITIONS

A. SDR: Standard Dimension Ratio.

B. IPS: Iron Pipe Size.

C. CTS: Copper Tube Size.

D. ESCR: Environmental Stress Crack Resistance.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 15060.
   3. Certifications:
      a. Installer certification.
   4. Field quality control documents.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers of PE pipe are acceptable for natural gas applications:

1. Phillips Driscopipe.
2. Plexco.
3. Polypipe.

B. See Specification Section 15060.

C. Submit request for substitution in accordance with Specification Section 01640.

2.2 PE 3408 PIPING

A. General:

1. Provide PE 3408 piping with fittings and appurtenances to locations shown on Drawings.
2. Furnish materials in accordance with ASTM D2513 and full compliance to the following material specifications:
   a. Material description: ASTM D1248, Type III, Class C, Category 5, Grade P34.
   b. Cell classification: ASTM D3350, PE 345434C.
   c. ESCR: ASTM D1693, condition C, F>5,000 HRS.
4. Hardness: ASTM D2240, 65 Shore D.
5. SDR: 11.0.
6. IPS for line size greater than 1 IN.
7. CTS for line size less than or equal to 1 IN.

B. Fittings:

1. ASTM D2513.
2. SDR: 11.0.
3. 1/2 to 3 IN: ASTM D2683.
4. 4 to 10 IN: ASTM D3261.
5. End connections:
   a. Socket fused ends for fittings 1 IN and under.
   b. Butt-fused ends for fitting 1-1/2 IN and greater.
6. Use IPS reducers on the service mains.
7. Use tapping tees or straight outlet service saddles to join service lines to the main.
8. Mitered or field fabricated fittings are not allowed.

C. Installation: Install pipe and fittings in accordance with ASTM D2683 and as recommended by the manufacturer.

1. Provide for a maximum deflection of not more than 3 percent.
2. PE 3408 shall not be field threaded and such threaded joints shall not be used in gas distribution systems.

D. Deflection:

1. After backfilling, each section of pipe shall be checked for deflection by pulling a mandrel through the pipe.
2. Pipe with deflection exceeding 5 percent of the inside diameter shall have backfill removed and replaced to provide a deflection of less than 5 percent.
3. Any repaired pipe shall be retested.

E. Utility Inter-Tie:

1. Provide insulated flange to connect to utility meter station.
2. Above ground piping shall be Schedule 40, ASTM A53.
3. Provide in accordance with Drawings.
4. Paint exposed steel piping.
   a. Prep in accordance with SSPC SP 3.
   b. Paint pipe with Tnemec Series 66: Two (2) coats at 3 mils DFT and one (1) coat Series 74 at 2.5 mils DFT.

F. PE 3408 to Steel Transition Fittings: Use anodeless riser.

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. Identify each length of pipe clearly at intervals of 5 FT or less.
   1. Include manufacturer's name and trademark.
   2. Nominal size of pipe, appurtenant information regarding polymer cell classification and critical identifications regarding performance specifications, and "NSF" approvals when applicable.

3.2 INSTALLATION

A. See Specification Section 15060.

B. General:
   1. Install buried pipe as indicated on Drawings.
   2. Contractor shall insure that kinking or excessive bend diameters of the pipe do not occur during the installation process.
   3. Contractor shall insure that the pipe installed in the trench is firmly supported.
   4. Contractor shall cap all open pipe ends at the end of the work day.
   5. All installed valves shall be tested in the presence of the Engineer.
      a. All repairs deemed necessary by the Engineer shall be made by the Contractor.
   6. Contractor shall remove any cave-in portions of the trench prior to placing sand bagging around the pipe.
   7. HDPE pipe and fittings shall be by the same manufacturer.
      a. The minimum strength of the fittings shall not be less than that of the pipe.
   8. Service taps shall be installed as shown on the Drawings.
   9. Changes in direction of PE Pipe:
      a. Pipe may be cold-bent to minimum radius of 20 times the pipe diameter as it is installed.
      b. If fittings or fusions are present in the bend, the minimum recommended cold bending radius is 125 times the outside diameter of the pipe.
   10. Remove cutting and threading burrs.

C. Joining Procedures:
   1. HDPE pipe joints shall be fused on the surface prior to installation into the trench.
      a. Alternative methods of fusing shall be approved by the Engineer.
      b. PE pipe 1 IN and under shall be socket fused.
      c. PE pipe joints 1-1/2 IN and over shall be buttfused.
   2. Fusion joiner must be qualified by type of fusion (i.e., butt fusion, socket fusion or sidewall fusion) and fuse pipe only as qualified.
   3. Each joint must be visually inspected inside and outside for damage, dirt, moisture, or any other abnormalities prior to fusing.
   4. All joint fusion shall be performed in strict accordance with the manufacturer's specifications.
   5. All fusion equipment must be approved by the manufacturer and operated by qualified and certified operators.
      a. Cost for testing and certifying personnel shall be born by the Contractor.

END OF SECTION
SECTION 15090

PIPE SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe support and anchor systems.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 09905 - Painting and Protective Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
   2. ASTM International (ASTM):
   3. American Welding Society (AWS):
      a. D1.1, Structural Welding Code - Steel.
   4. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
      a. SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
      b. SP-69, Pipe Hangers and Supports - Selection and Application.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Itemized list of wall sleeves, anchors, support devices and all other items related to pipe support system.
      d. Scale drawings showing guides, hangers, supports, anchors, structural members and appurtenances to describe the pipe support system.

1.4 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

B. Submit request for substitution in accordance with Specification Section 01640.
1.5 MANUFACTURED UNITS

A. Hanger Rods:
   1. Material:
      a. ASTM A36.
      b. ASTM A575, Grade M1020.
      c. ASTM A576, Grade 1020.
      d. Minimum allowable tensile stress of 12,000 psi at 650 DegF per MSS SP-58.
   2. Continuously threaded.
   3. Electro-galvanized or cadmium plated after threads are cut.
   4. Load limit:

<table>
<thead>
<tr>
<th>NOMINAL ROD DIAMETER</th>
<th>MAXIMUM SAFE LOAD, (LBS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 IN DIA (min)</td>
<td>610</td>
</tr>
<tr>
<td>1/2 IN DIA</td>
<td>1,130</td>
</tr>
<tr>
<td>5/8 IN DIA</td>
<td>1,810</td>
</tr>
<tr>
<td>3/4 IN DIA</td>
<td>2,710</td>
</tr>
<tr>
<td>7/8 IN DIA</td>
<td>3,770</td>
</tr>
<tr>
<td>1 IN DIA</td>
<td>4,960</td>
</tr>
</tbody>
</table>

B. Hangers:
   1. Hangers for use directly on copper pipe: Copper or cadmium plated.
   2. Hangers for use other than directly on copper pipe: Cadmium plated or galvanized.
   3. Hanger type schedule:

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>PIPE SIZE</th>
<th>HANGER TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>All except noted</td>
<td>4 IN and less</td>
<td>ANVIL Figure 108 with Figure 114</td>
</tr>
<tr>
<td>All except noted</td>
<td>Over 4 IN</td>
<td>ANVIL Figure 590</td>
</tr>
<tr>
<td>Steam, condensate and hot water</td>
<td>All</td>
<td>ANVIL Figure 181, Figure 82</td>
</tr>
</tbody>
</table>

C. Concrete Inserts for Hanger Rods:
   1. Continuous slots: Unistrut #P1000.
   2. Individual inserts: ANVIL Figure 281.
   3. Self-drilling expansion anchors: Phillips flush-end or snap-off end type.

D. Beam Clamps for Hanger Rods:
   1. Standard duty.
   2. ANVIL Figure 133.

E. Trapeze Hangers for Suspended Piping:
   1. Material: Steel.
   2. Galvanized.
   3. Angles, channels, or other structural shapes.
   4. Curved roller surfaces at support point corresponding with type of hanger required.

F. Vertical Pipe Supports:
   1. At base of riser.
   2. Lateral movement:
      a. Clamps or brackets:
      1) ANVIL Figure 103.

G. Expanding Pipe Supports:
   1. Spring hanger type.
   2. MSS SP-58.
H. Pipe Support Saddle:
   1. For pipe located 3 FT or less from floor elevation, except as otherwise indicated on
      Drawings.
   2. ANVIL Figure 264.

I. Pipe Support Risers:
   1. Schedule 40 pipe.
   2. Galvanized.
   3. As recommended by saddle manufacturer.

J. Pipe Support Base Plate:
   1. 4 IN larger than support.
   2. Collar 3/16 IN thickness, circular in shape, and sleeve type connection to pipe.
   3. Collar fitted over outside of support pipe and extended 2 IN from floor plate.
   4. Collar welded to floor plate.
   5. Edges ground smooth.
   6. Assembly hot-dipped galvanized after fabrication.

K. Pipe Covering Protection Saddle:
   1. For insulated pipe at point of support.
   2. ANVIL Figure 167, Type B.

L. Wall Brackets:
   1. For pipe located near walls and 8 FT or more above floor elevation or as otherwise indicated
      on the Drawings.
   2. ANVIL Figure 199.

M. Pipe Anchors:
   1. For locations shown on the Drawings.
   2. 1/4 IN steel plate construction.
   3. Hot-dipped galvanized after fabrication.
   4. Designed to prevent movement of pipe at point of attachment.

N. Pipe Guides:
   1. For locations on both sides on each expansion joint or loop.
   2. To ensure proper alignment of expanding or contracting pipe.
   3. ANVIL Figure 256.

1.6 DESIGN REQUIREMENTS

A. Supports capable of supporting the pipe for all service and testing conditions.
   1. Provide 5 to 1 safety factor.

B. Allow free expansion and contraction of the piping to prevent excessive stress resulting from
   service and testing conditions or from weight transferred from the piping or attached equipment.

C. Design supports and hangers to allow for proper pitch of pipes.

D. For chemical and waste piping, design, materials of construction and installation of pipe
   hangers, supports, guides, restraints, and anchors:
   1. ASME B31.3.
   2. MSS SP-58 and MSS SP-69.
   3. Except where modified by this Specification.

E. For steam and hot and cold water piping, design, materials of construction and installation of
   pipe hangers, supports, guides, restraints, and anchors:
   1. ASME B31.1.
   2. MSS SP-58 and MSS SP-69.

F. Check all physical clearances between piping, support system and structure.
   1. Provide for vertical adjustment after erection.
G. Support vertical pipe runs in pipe chases at base of riser.
   1. Support pipes for lateral movement with clamps or brackets.

H. Place hangers on outside of pipe insulation.
   1. Use a pipe covering protection saddle for insulated pipe at support point.
   2. Insulated piping 1-1/2 IN and less: Provide a 9 IN length of 9 LB density fiberglass
      insulation at saddle.
   3. Insulated piping over 1-1/2 IN: Provide a 12 IN length of 9 LB density fiberglass insulation
      on saddle.

I. Provide 20 GA galvanized steel pipe saddle for fiberglass and plastic support points to ensure
   minimum contact width of 4 IN.

J. Pipe Support Spacing:
   1. General:
      a. Factor loads by specific weight of liquid conveyed if specific weight is greater than
         water.
      b. Locate pipe supports at maximum spacing scheduled unless indicated otherwise on the
         Drawings.
      c. Provide at least one (1) support for each length of pipe at each change of direction and
         at each valve.
   2. Steel, stainless steel, cast-iron pipe support schedule:

<table>
<thead>
<tr>
<th>PIPE SIZES - IN</th>
<th>MAXIMUM SPAN - FT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/2 and less</td>
<td>5</td>
</tr>
<tr>
<td>2 thru 4</td>
<td>10</td>
</tr>
<tr>
<td>5 thru 8</td>
<td>15</td>
</tr>
<tr>
<td>10 and greater</td>
<td>20</td>
</tr>
</tbody>
</table>

3. Copper pipe support schedule:

<table>
<thead>
<tr>
<th>PIPE SIZES - IN</th>
<th>MAXIMUM SPAN - FT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1/2 and less</td>
<td>5</td>
</tr>
<tr>
<td>3 thru 6</td>
<td>10</td>
</tr>
<tr>
<td>8 and greater</td>
<td>15</td>
</tr>
</tbody>
</table>

4. PVC pipe support schedule:

<table>
<thead>
<tr>
<th>PIPE SIZES - IN</th>
<th>MAXIMUM SPAN - FT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/4 and less</td>
<td>3</td>
</tr>
<tr>
<td>1-1/2 thru 3</td>
<td>4</td>
</tr>
<tr>
<td>4 and greater</td>
<td>5</td>
</tr>
</tbody>
</table>

* Maximum fluid temperature of 120 DegF.

5. Support each length and every fitting:
   a. Bell and spigot piping:
      1) At least one (1) hanger.
      2) Applied at bell.
   b. Mechanical coupling joints:
      1) Place hanger within 2 FT of each side of fittings to keep pipes in alignment.

6. Space supports for soil and waste pipe and other piping systems not included above every
   5 FT.

7. Provide continuous support for nylon tubing.
PART 2 - EXECUTION

2.1 INSTALLATION

A. Provide piping systems exhibiting pulsation, vibration, swaying, or impact with suitable constraints to correct the condition.
   1. Included in this requirement are movements from:
      a. Trap discharge.
      b. Water hammer.
      c. Similar internal forces.

B. Weld Supports:
   1. AWS D1.1.
   2. Weld anchors to pipe in accordance with ASME B31.3.

C. Locate piping and pipe supports as to not interfere with open accesses, walkways, platforms, and with maintenance or disassembly of equipment.

D. Inspect hangers for:
   1. Design offset.
   2. Adequacy of clearance for piping and supports in the hot and cold positions.
   3. Guides to permit movement without binding.
   4. Adequacy of anchors.

E. Inspect hangers after erection of piping systems and prior to pipe testing and flushing.

F. Install individual or continuous slot concrete inserts for use with hangers for piping and equipment.
   1. Install concrete inserts as concrete forms are installed.

G. Welding:
   2. Integral attachments:
      a. Include welded-on ears, shoes, plates and angle clips.
      b. Ensure material for integral attachments is of good weldable quality.
   3. Preheating, welding and postheat treating: ASME B31.3, Chapter V.

H. Field Painting:
   1. Comply with Specification Section 09905.

END OF SECTION
SECTION 15100
VALVES: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Valving, actuators, and valving appurtenances.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 09905 - Painting and Protective Coatings.
   4. Section 11005 - Equipment: Basic Requirements.
   5. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B1.20.1, Pipe Threads, General Purpose.
      c. B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
   2. ASTM International (ASTM):
         Fittings.
      b. D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of
         Plastics.
         Load in the Edgewise Position.
   3. American Water Works Association (AWWA):
      a. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through
         144 IN.
      d. C507, Standard for Ball Valves, 6 IN through 48 IN (150 MM through 1200 MM).
      g. C606, Standard for Grooved and Shouldered Joints.
      a. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and
         Fittings.
   5. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. MG 1, Motors and Generators.
1.3 DEFINITIONS

A. The following are definitions of abbreviations used in this Specification Section or one (1) of the individual valve sections:
   1. CWP: Cold water working pressure.
   2. SWP: Steam working pressure.
   3. WOG: Water, oil, gas working pressure.
   4. WWP: Water working pressure.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Valve pressure and temperature rating.
      d. Valve material of construction.
      e. Special linings.
      f. Valve dimensions and weight.
      g. Valve flow coefficient.
      h. Wiring and control diagrams for electric or cylinder actuators.
   3. Test reports.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01342 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

C. Informational Submittals:
   1. Verification from valve actuator manufacturer that actuators have been installed properly, that all limit switches and position potentiometers have been properly adjusted, and that the valve actuator responds correctly to the valve position command.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to individual valve Specification Sections for acceptable manufacturers.

2.2 MATERIALS

A. Refer to individual valve Specification Sections.

2.3 VALVE ACTUATORS

A. Valve Actuators - General:
   1. Provide actuators as shown on Drawings or specified.
   2. Counter clockwise opening as viewed from the top.
   3. Direction of opening and the word OPEN to be cast in handwheel or valve bonnet.
   4. Size actuator to produce required torque with a maximum pull of 80 LB at the maximum pressure rating of the valve provided and withstand without damage a pull of 200 LB on handwheel or chainwheel or 300 foot-pounds torque on the operating nut.
   5. Unless otherwise specified, actuators for valves to be buried, submerged or installed in vaults or manholes shall be sealed to withstand at least 20 FT of submergence.
6. Extension stem:
   a. Install where shown or specified.
   b. Solid steel with actuator key and nut, diameter not less than stem of valve actuator shaft.
   c. Pin all stem connections.
   d. Center in valve box or grating opening band with guide bushing.

B. Buried Valve Actuators:
1. Provide screw or slide type adjustable cast iron valve box, 5 IN minimum diameter, 3/16 IN minimum thickness, and identifying cast iron cover rated for traffic load.
2. Box base to enclose buried valve gear box or bonnet.
3. Provide 2 IN standard actuator nuts complying with AWWA C500, Section 3.16.
4. Provide at least two (2) tee handle keys for actuator nuts, with 5 FT extension between key and handle.
5. Extension stem:
   a. Provide for buried valves greater than 4 FT below finish grade.
   b. Extend to within 6 IN of finish grade.
6. Provide concrete pad encasement of valve box as shown for all buried valves unless shown otherwise.

C. Plastic Valve Vault:
1. Provide in non-traffic areas only on valve applications 3-1/2 IN and less.
2. Nominal 7-1/2 IN DIA top section.
3. Design unit for screw type extension section having nominal 9 IN DIA bell.
4. Cast iron ring and lid.
5. Constructed of injection molded polyolefin compound with fibrous inorganic component reinforcing and UV stabilization.
6. Armor Access Boxes.

D. Exposed Valve Manual Actuators:
1. Provide for all exposed valves not having electric or cylinder actuators.
2. Provide handwheels for gate and globe valves.
   a. Size handwheels for valves in accordance with AWWA C500.
3. Provide lever actuators for plug valves, butterfly valves and ball valves 3 IN DIA and smaller.
   a. Lever actuators for butterfly valves shall have a minimum of 5 intermediate lock positions between full open and full close.
   b. Provide at least two (2) levers for each type and size of valve furnished.
4. Gear actuators required for plug valves, butterfly valves, and ball valves 4 IN DIA and larger.
5. Provide gearing for gate valves 20 IN and larger in accordance with AWWA C500.
6. Gear actuators to be totally enclosed, permanently lubricated and with sealed bearings.
7. Provide chain actuators for valves 6 FT or higher from finish floor to valve centerline.
   a. Cadmium-plated chain looped to within 3 FT of finish floor.
   b. Equip chain wheels with chain guides to permit rapid operation with reasonable side pull without "gagging" the wheel.
8. Provide cast iron floor stands where shown on Drawings.
   a. Stands to be furnished by valve manufacturer with actuator.
   b. Stands or actuator to include thrust bearings for valve operation and weight of accessories.

E. Submerged Actuators:
1. Mount the valve actuator on top of an extension bonnet 3 FT above any adjacent personnel access.
2. The valve and bonnet connection shall be flanged and watertight.
3. Provide a top brace support for the bonnet.
   a. Mount the brace 6 IN below the top of the wall as shown.
4. Materials:
   a. Extension bonnet: Cast iron ASTM A126 or steel.
   b. Brace and anchor bolts: Type 304 stainless steel.

2.4 FABRICATION

A. End Connections:
1. Provide the type of end connections for valves as required in the Piping Schedules presented in Specification Section 15060 or as shown on the Drawings.
2. Comply with the following standards:
   b. Flanged: ASME B16.1, Class 125 unless otherwise noted or AWWA C207.
   c. Bell and spigot or mechanical (gland) type: AWWA/ANSI C111/A21.11.
   e. Grooved: Rigid joints per Table 5 of AWWA C606.

B. Refer to individual valve Specification Sections for specifications of each type of valve used on Project.

C. Nuts, Bolts, and Washers:
1. Wetted or internal to be bronze or stainless steel.
   a. Exposed to be zinc or cadmium plated.

D. On Insulated Piping: Provide valves with extended stems to permit proper insulation application without interference from handle.

E. Epoxy Interior Coating: Provide epoxy interior coating for all ferrous surfaces in accordance with AWWA C550.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Painting Requirements: Comply with Specification Section 09905 for painting and protective coatings.

C. Setting Buried Valves:
1. Locate valves installed in pipe trenches where buried pipe indicated on Drawings.
2. Set valves and valve boxes plumb.
3. Place valve boxes directly over valves with top of box being brought to surface of finished grade.
4. Install in closed position.
5. Place valve on firm footing in trench to prevent settling and excessive strain on connection to pipe.
6. After installation, backfill up to top of box for a minimum distance of 4 FT on each side of box.

D. Support exposed valves and piping adjacent to valves independently to eliminate pipe loads being transferred to valve and valve loads being transferred to the piping.

E. For grooved coupling valves, install rigid type couplings.

F. For threaded valves, provide union on one (1) side within 2 FT of valve to allow valve removal.

G. Install valves accessible for operation, inspection, and maintenance.
3.2 ADJUSTMENT

A. Adjust valves, actuators and appurtenant equipment to comply with Specification Section 01650.

1. Operate valve, open and close at system pressures.

END OF SECTION
SECTION 15102
PLUG VALVES

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Plug valves.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 15100 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE
A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
   2. ASTM International (ASTM):
         Fittings.
   3. American Water Works Association (AWWA):

1.3 SUBMITTALS
A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. See Specification Section 15100.
B. Operation and Maintenance Manuals:
   1. See Specification Section 01342 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.
   2. See Specification Section 15100.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Subject to compliance with the Contract Documents, the manufacturers listed under the specific
   valve types are acceptable.
B. Submit request for substitution in accordance with Specification Section 01640.

2.2 LUBRICATED SEAL PLUG VALVES (NATURAL GAS APPLICATIONS)
A. Acceptable Manufacturers:
   2. Walworth.
3. Millikin.

B. Materials:
1. Body: Cast iron ASTM A126, Class B.
2. Plug: Cast iron ASTM A126, Class B.
3. Plug facing: Teflon on tapered plug.

2.3 NON-LUBRICATED ECCENTRIC PLUG (HEATING-COOLING WATER APPLICATIONS)

A. Acceptable Manufacturers:
1. DeZurik Figure 499.

B. Materials:
1. Body: Cast iron, ASTM A126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Bearings: Bronze or nickel.

2.4 ACCESSORIES

A. Refer to Drawings and valve schedule for type of actuator.
1. Furnish actuator integral with valve.

B. Refer to Specification Section 15100 for actuator requirements.

2.5 DESIGN REQUIREMENTS

A. Non-Lubricated Eccentric Plug Valves (Wastewater, Sludge):
1. Port area:
   a. Valves 4 IN through 20 IN: Equal to or exceed 80 percent of full pipe area.
   b. Valves greater than 20 IN: 100 percent equivalent full pipe area.
2. Valve body: Fitted with bolted bonnet.
4. Stem seal: Adjustable and replaceable without disassembling valve or bonnet.
5. Designed for seating drip tight in any flow direction.
6. Rating:
   a. 1/2 through 12 IN, 175 psi working pressure.
   b. 14 through 36 IN, 150 psi working pressure.
   c. Three-way valves, 125 psi working pressure.
7. Actuator:
   a. Actuator gearing in enclosure suitable for running in oil with seals on shaft to prevent entry of dirt or water.
   b. Positive identification on actuator indicating valve position.
   c. Adjustable stop to set closing torque.

B. Lubricated Plug Valves (Natural Gas):
1. Pressure lubricated valve with sealed ports and grooves.
   a. Re-seatable under full pressure in any position.
2. Pressure rating: 200 psi WOG.
3. Port area: Minimum 60 percent of pipe area.
4. Acceptable to local gas company.

C. Non-Lubricated Eccentric Plug Valve-(HVAC):
1. Port area: Valves 1/2 IN through 2-1/2 IN: Equal to or exceed 100 percent of full pipe area.
2. Valve body: Fitted with threaded bonnet or bolted bonnet.
3. End connections:
   a. Flanges: In full accordance with ASME B16.1, Class 125 including facing, drilling and
      thickness.
   b. Threaded connection: In full compliance with NPT.


5. Shut-off: Designed for setting drip-tight at the full rated pressure.

2.6 FABRICATION

A. See Specification Section 15100.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Specification Section 15100.

B. Install valves with valve stem horizontal, plug seat on inlet side and with plug rotating up into
   the open position for valves in horizontal lines.

C. Install valve with actuator above pipe or plug centerline.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Ball valves.
B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 15100 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and
         Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

1.3 DEFINITIONS

A. PVDF: Polyvinylidene fluoride.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal
      process.
   2. See Section 15100.

B. Operation and Maintenance Manuals:
   1. See Section 01340 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable
   Articles below are acceptable.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 PLASTIC BALL VALVES: 1/2 IN TO 4 IN DIA

A. Acceptable Manufacturers:
   1. Spears.
   2. ASAHI/America.

B. Materials:
   1. Body, stem, ball, handle, end connectors:
      a. PVC ASTM D1784-12454B.
   2. Ball Seat: Teflon.

C. Design Requirements:
1. For sodium hydroxide application: Compatible with 50 percent concentration at ambient temperature.
2. Rated at 230 psi at 73 DegF.
3. Double or "true union" design.
4. Blocks both directions, upstream and downstream.
5. Union nut capable of compensating for seat wear.
6. Body with mounting pad for actuators where required.
7. Capable of being disconnected at downstream end under full line pressure.
8. Handle extension:
   a. Provide handle extension for chemical unloading station valve.
   b. Provide wall collar for shaft in the wall penetration.

2.3 ACCESSORIES

A. Refer to Drawings and valve schedule for type of actuators.
   1. Furnish actuator integral with valve.
B. Refer to Section 15100 for actuator requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 15100.
B. Provide manual ball valves with quarter turn operators for plumbing shut-off and isolation service.

END OF SECTION
SECTION 15106
CHECK VALVES

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Check valves.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 15100 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE
A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
   2. American Water Works Association (AWWA):
      a. C508, Standard for Swing-Check Valves for Waterworks Service, 2 IN through 24 IN NPS.
   3. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
      a. SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
      b. SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.3 DEFINITIONS
A. PVDF: Polyvinylidene fluoride.

1.4 SUBMITTALS
A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 15100.
B. Operation and Maintenance Manuals:
   1. See Specification Section 01340 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Subject to compliance with the Contract Documents, manufacturers listed under the valve with types are acceptable.
B. Submit request for substitution in accordance with Specification Section 01640.

2.2 BALL CHECK VALVES: 1/2 IN TO 4 IN
A. 150 psi at 73 DegF.
B. Acceptable Manufacturers:
   1. Chemtrol.
   2. Asahi/America.

C. Materials:
   1. Body: PVC.
   2. Ball: Glass filled or polypropylene.
   3. Seals: Teflon, PFTE.

D. Design Requirements:

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Specification Section 15100.

B. Install in accordance with manufacturer's instructions.

END OF SECTION
SECTION 15114
MISCELLANEOUS VALVES

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
1. Pressure relief valves (1 in and smaller-chemical applications).

B. Related Sections include but are not necessarily limited to:
1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 1 - General Requirements.
3. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.
4. Section 15100 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE
A. Referenced Standards:
1. American Water Works Association (AWWA):
2. ASTM International (ASTM):

1.3 SUBMITTALS
A. Shop Drawings:
1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
2. See Section 15100.
3. Documentation of chemical compatibility for valve materials used in chemical applications.
B. Operation and Maintenance Manuals:
1. See Section 01340 for requirements for:
   a. The mechanics and administration of the submittal process.
   b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Subject to compliance with the Contract Documents, the manufacturers listed under the specific valve types are acceptable.

2.2 PRESSURE RELIEF VALVES (1 IN AND SMALLER - CHEMICAL APPLICATIONS)
A. Acceptable Manufacturers:
1. Chemline.
2. Plast-O-Matic.
B. Chemical Characteristics:

<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>CONCENTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Hydroxide</td>
<td>50% NaOH</td>
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</tbody>
</table>

C. Materials of Construction:
1. For the various applications, provide materials of construction rated acceptable for the chemical concentration defined above.
2. Provide documentation in Shop Drawing of chemical compatibility for specific chemical application in which the equipment is used.

D. Design Requirements:
1. External pressure setting.
2. True union design.
3. In-line or angle pattern design to suit application.

2.3 ACCESSORIES
A. Furnish any accessories required to provide a completely operable valve.

2.4 FABRICATION
A. Completely shop assemble unit including any interconnecting piping, speed control valves, control isolation valves and electrical components.
B. Provide internal epoxy coating suitable for potable water for all iron body valves in accordance with AWWA C550.

PART 3 - EXECUTION

3.1 INSTALLATION
A. General:
   1. See Section 15100.
B. Air Release, Vacuum Relief, and Pressure Relief Valves:
   1. For chemical applications, utilize schedule 80 PVC piping.

3.2 FIELD QUALITY CONTROL
A. Clean, inspect, and operate valve to ensure all parts are operable and valve seats properly.
B. Check and adjust valves and accessories in accordance with manufacturer's instructions and place into operation.

3.3 SCHEDULES
A. Valves are defined on Drawings in plan, section, isometric or schematic.
B. See Section 15060 and the Drawings for Piping Service designations.

END OF SECTION
SECTION 15183
PIPE, DUCT AND EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Insulation:
      a. Piping insulation.
      b. Duct insulation.
      c. Equipment insulation.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):

   2. National Fire Protection Association (NFPA):

   3. Underwriters Laboratories, Inc. (UL):

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.

   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
c. Submit complete specification of insulation materials, adhesives, cement, together with manufacturer's recommended methods of application and coverage for coatings and adhesives.

3. Submit itemized schedule by building of proposed insulation systems showing density, thermal conductivity, thickness, adhesive, jackets and vapor barriers.

4. Certifications: Products will meet the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Fiberglass insulation:
   a. Certainteed Corporation.
   b. Schuller (Manville).
   c. Owens Corning.
   d. Knauf.

2. PVC jacket:
   a. Ceel-Co.
   b. PIC Plastics.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 PIPING INSULATION - FIBERGLASS

A. Pipe and Fitting Insulation:

1. Preformed fiberglass pipe insulation:
   a. Density: 4 LBS/CF.
   b. Temperature rated: 650 DegF.
   c. Average thermal conductivity not to exceed 0.22 (Btu-IN)/(HR-FT²-DegF) at mean temperature of 75 DegF.
   d. Fire hazard rating:
      1) UL 723, ASTM E84, NFPA 255.
      2) Flame spread not exceeding 25 and smoke developed not exceeding 50.

2. Moisture adsorption:
   a. ASTM C553.
   b. Not greater than 0.5 percent moisture by volume when exposed to moisture laden air at 120 DegF and 96 percent RH.

3. Fungi and bacteria resistance:
   a. ASTM C665.
   b. Does not breed or promote growth.
   c. Flame attenuated glass fibers bonded with thermosetting resin.

4. Piping jackets (general applications):
   b. PVC: Preformed 0.028 IN thick PVC jackets fabricrated from B.F. Goodrich PVC sheeting V-66 with proven resistance to ultraviolet degradation when temperatures do not exceed the limits of PVC.
   c. Piping jacket not required on concealed piping.

5. Provide minimum insulation thickness conforming to schedules or as shown on the Drawings.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. General:
   1. Consider ductwork, piping and equipment as exposed, except as otherwise indicated.
   2. Consider ductwork, piping and equipment in walls, partitions, floors, pipe chases, pipe
      shafts and duct shafts as concealed.
      a. Consider ductwork, piping and equipment above ceilings as concealed.
   3. Provide release for insulation application after installation and testing is complete.
      a. Apply insulation on clean, dry surfaces after inspection.
   4. Provide insulation continuous through wall, roof and ceiling openings, pipe hangers,
      supports and sleeves.
   5. Provide insulation with vapor barrier for piping, ductwork and equipment where surfaces
      may be cooler than surrounding air temperatures.
      a. Provide vapor barrier (0.17 perm-IN; ASTM C553) continuous and unbroken.
      b. Hangers, supports, anchors, and related items that are secured directly to cold surfaces
         must be adequately insulated and vapor-sealed to prevent condensation.
   6. Provide specified adhesives, mastic and coatings at the manufacturer's recommended
      coverage per unit volume.

C. Piping Insulation - Fiberglass:
   1. Apply over clean dry pipe.
      a. Butt all joints together firmly.
   2. Seal joints, slits, miter-cuts and other exposed edges of insulation as recommended by the
      insulation manufacturer.
   3. Insulate fittings, valves, and flanges with insulation thickness equal to adjacent pipe.
   4. PVC pipe jacket:
      a. Apply jacketing with a minimum of 1 IN overlap.
         1) Weld longitudinal and circumferential seams with adhesives as recommended by
            manufacturer.
      b. Provide slip-joints every 30 FT and between fittings if distance exceeds 8 FT.
         1) Construct slip-joints by overlapping jacket sections 6 to 10 IN.
      c. Provide premolded PVC covers of same material and manufacturer as jacket for
         fittings, valves, flanges, and related items in insulated piping systems.
   5. Aluminum pipe jacket:
      a. Field-applied aluminum jacket with vapor-sealed longitudinal and butt joints.
      b. Provide smooth and straight joint with a minimum 2 IN overlap.
      c. Secure joints with corrosion-resistant screws spaced 0.25 to 0.50 IN back from edge.
      d. Center spacing of screws 5 IN maximum or as required to provide smooth tight-fitted
         joints.
      e. Place joints on least exposed side of piping to obtain neat appearance.

3.2 REPAIR

A. Whenever any factory applied insulation or job-applied insulation is removed or damaged,
   replace with the same quality of material and workmanship.
3.3 SCHEDULES

A. Pipe, Fittings and Valves:
   1. Fiberglass.

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>PIPE SIZE</th>
<th>THICKNESS</th>
<th>JACKET</th>
</tr>
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<tbody>
<tr>
<td>Hot Water (domestic)</td>
<td>6 IN and less</td>
<td>3/4 IN</td>
<td>PVC</td>
</tr>
<tr>
<td>Cold Water (domestic)</td>
<td>3 IN and less</td>
<td>3/4 IN</td>
<td>PVC</td>
</tr>
<tr>
<td></td>
<td>Over 3 IN</td>
<td>1 IN</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 15440
PLUMBING FIXTURES AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes: Plumbing fixtures, trim, and equipment.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   4. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE
A. Referenced Standards:
   1. Americans with Disabilities Act (ADA):
   4. American Society of Mechanical Engineers (ASME):
   5. American Society of Sanitation Engineers (ASSE):
      a. 1011, Performance Requirements for Hose Connection Vacuum Breaker.
   6. Canadian Standards Association (CSA).
   7. NSF International (NSF).
   8. Underwriters Laboratories, Inc. (UL).
   9. Building Code:
      a. International Code Council (ICC):

1.3 SUBMITTALS
A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 11005 and Specification Section 15060.
   4. Fabrication and/or layout Drawings:
      a. Layout plan(s) showing dimensions, elevations, etc.
      b. Details showing connections, installation, rough-in locations, etc.
   5. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Chemical-resistance data.
B. Operation and Maintenance Manuals:
   1. See Specification Section 01342 for requirements for:
      a. The mechanics and administration of the submittal process.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Emergency shower and eyewash:
   a. Speakman.
   b. Haws.
   c. Guardian Equipment.

2. Drains:
   a. Wade.
   b. Josam.
   c. Zurn.
   d. Smith.

3. Hose bibbs:
   a. Nibco.
   b. Woodford.

4. Hydrants:
   a. Wade.
   b. Josam.
   c. Smith.

5. Domestic water heater:
   a. A. O. Smith.
   b. Ruud.
   c. Rheem.
   d. State.

6. Reduced pressure backflow preventer:
   a. Watts.
   b. Febco.
   c. Clayton.

7. Mixing Valve:
   a. Lawler.
   b. Leonard.
   c. Speakman.
   d. Bradley.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MANUFACTURED UNITS

A. Emergency Fixtures:

1. Emergency shower and eye/face wash (ESEW):
   a. ANSI Z358.1.
   b. Constructed for outdoor installation (with internal plumbing); frost proof.
   c. Galvanized steel.
   d. Wall mounted.
   e. Flow switch:
      1) Rating: 125/250 V, 5 A.
      2) Single pole, double throw.
      3) UL listed.
   f. Deluge shower head:
      1) Stay-open ball valve.
      2) Pull-chain.
g. Eye/face wash:
   1) Bowl not required.
   2) Stay-open full port ball valve.
   3) Push handle control for eye/face wash.
   4) Supply line strainer for eye/face wash.

h. Type:
   1) ESEW-1 (freezeproof, wall-mounted): Bradley S19-310TW.

B. Mixing Valve, MV-1:
3. Operating parameters:
   a. Flow control range: 3-64 gpm.
   c. Minimum flow at maximum pressure drop of 10 psig: 29 gpm.
   d. Output temperature range: 60-90 DegF.
   1) Maintain output temperature range to a minimum flow of 3 gpm.
   e. HW supply temperature: 90 DegF.
   f. Supply pressure range: 40-80 psig.
   g. Mixing valve bypass: Cold water by-pass if valve should fail.

C. Drains:
1. Floor drain (FD):
   a. Bottom outlet.
   b. Clamping seepage flange.
   c. Seepage openings.
   d. Size as shown on Drawings.
   e. Type: Cast iron body.
      1) FD-1 (unfinished area) sediment bucket, bucket shall support grate: Wade W-1200-TD.

D. Hose Bibb (HB-1):
1. 3/4 IN boiler drain with attached vacuum breaker-backflow preventer.
2. Vacuum breaker: Non-removable, manual draining, meeting the requirements of the ASSE 1011.

E. Hydrants (WH):
1. Wall hydrant:
   a. Non-freeze.
   b. Integral vacuum breaker.
   c. Nylon seat.
   d. 3/4 IN hose connection.
   e. 3/4 IN inlet connection.
   f. Length as recommended by manufacturer for wall thickness.
   g. Type:
      1) WH-1 (exposed) Wade 8600.

F. Domestic Water Heater (DWH):
1. Gas-fired tank type:
   a. Size and capacity as scheduled on Drawings.
   b. Certified by CSA and bear NSF approval.
   c. Provide internal surfaces:
      1) Glass-lined with alkaline borosilicate composition fused-to-steel.
      2) Provide magnesium rods rigidly supported for cathodic protection.
   d. Equip heaters with safety shutoff in case of pilot failure, gas pressure regulator, certified draft diverter and pressure and temperature relief valve.
   e. Insulate tank with vermin-proof glass fiber insulation or equal.
   f. Heavy gage steel jacket with baked enamel finish over bonderized undercoating.
g. Warranty against corrosion for three (3) year period.

G. Reduced Pressure Backflow Preventer:
1. Backflow preventers consist of two (2) check valves, test cocks and relief valve, all assembled as an integral unit.
2. Reduced pressure backflow preventers Watts 909.
3. Backflow preventer to have threaded ends in sizes through 2 IN, flanged 2-1/2 IN and larger.
4. Pressure loss through backflow preventer not exceeding 14 psi at design flow.
5. Provide air gap and pipe discharge to within 6 IN of finished floor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cross Connection: Do not install any plumbing components that will provide a cross connection between potable and non-potable or drainage systems.

B. Drains:
1. Install drains at locations indicated on Drawings and in compliance with local Codes.
2. In quarry tile floors:
   a. 24 x 24 IN 6 LB lead sheet clamped to drain.
   b. Set 1-1/2 IN above structural slab for mortar set and 1/2 IN for thin set.
3. In uncovered concrete slabs:
   a. Install at the low points of surface areas to be drained or as indicated.
   b. Set tops of drains flush with the finished floor.
   c. Install drain flashing collar or a flange so that no leakage occurs between the drain and the adjoining surfaces.
   d. Maintain the integrity of waterproof membranes, where penetrated.
4. Trench drains:
   a. Install in accordance with manufacturer's instructions and approved Shop Drawings.
   b. Install trench sections with the top edges level and straight at elevations indicated.
      1) Support channel sections in place while concrete is placed under and around sections as indicated.

C. Wall Hydrants:
1. Install 24 IN above exterior grade.
2. Support units from the structure and mount flush with structure face.
3. Prior to final setting, fill the back of the face with a non-hardening silicone calk and press firmly in place to stop infiltration and water leakage.
4. Install isolation valves in line to each wall hydrant.

D. Hose Bibbs:
1. Install 36 IN above finished floor.
2. In exterior locations, provide interior isolation valve.

E. Water Heater:
1. Install all water heaters in accordance with details, manufacturer's recommendations, and applicable Codes.
2. For units located on concrete pads, plumb level and orient to allow access to the controls, elements and other items requiring service.
3. Connect hot and cold water piping to the unit with line-size, isolation valves and dielectric unions.
4. Connect recirculating hot water to cold inlet piping with unions and valves at check valves as detailed.
5. Connect gas piping as detailed in accordance with Specification Section 15060 and located so as not to interfere with the unit service.
6. Connect combustion air and flue piping. Use materials as recommended by manufacturer.
   Terminate through roof with concentric vent kit as shown.
7. Start up the unit and adjust all controls for proper temperature control and maximum efficiency.
F. Reduce Pressure Backflow Preventer: Install on water lines as required by Code.

3.2 FIELD QUALITY CONTROL

A. Test piping and fixtures for leaks per Specification Section 15060.

END OF SECTION
SECTION 15605
HVAC: EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Heating, ventilating, and cooling equipment.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   4. Section 15890 - HVAC: Ductwork.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Air Movement and Control Association (AMCA).
   2. Air Conditioning and Refrigeration Institute (ARI).
   3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
      a. HVAC Applications Handbook, Chapter entitled "Sound and Vibration Control."
      b. 20, Methods of Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant
         Condensers.
      c. 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal
         Efficiency by Particle Size.
   4. Canadian Standards Association (CSA).
   5. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      a. 70, National Electrical Code (NEC).
   8. Underwriters Laboratories, Inc. (UL):
      a. 507, Standard for Electric Fans.
   9. Building Code:
      a. International Code Council (ICC):
            amendments, referred to herein as Building Code.

B. Miscellaneous:
   1. Gage thickness specified herein shall be manufacturer's standard gage for steel and Brown
      and Sharpe gage for non-ferrous metals.
   2. Corrosion protection of equipment to be as specified herein.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Fabrication and/or layout Drawings.
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Wiring diagrams.
d. Control diagrams.
e. Manufacturer's catalog cuts and technical data.
g. Fan curves.
h. Sound data.
i. Vibration isolation.
j. Control description.
k. Performance data on all equipment.

4. Certifications:
a. Provide certification of thickness of corrosion-protection coating.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Unit heaters - gas:
      a. Hastings.
      b. Modine Manufacturing Co.
   2. Wall-mounted centrifugal exhaust fans:
      a. Loren Cook.
      b. PennBarry Ventilator Co., Inc.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 GENERAL

A. All Manufactured Units:
   1. Comply with Specification Section 11005.
   2. Factory wired and assembled.
   3. Use fasteners made of same material as unit.

2.3 MANUFACTURED UNITS

A. Unit Heaters - Gas:
   1. CSA design certified.
   2. 80 percent thermal efficiency.
   4. Material:
      c. Burner: Aluminized or stainless steel.
      d. Casing: Steel.
   5. Fan motor:
      a. See Specification Section 11005.
      b. Built-in thermal overload protection.
   7. Adjustable air deflector blades.
   8. 24 V combination automatic gas valve.
11. Accessories:
   a. Mounting bracket.
   b. 40 to 90 DegF, 5 DegF differential wall-mounted thermostat.

12. Size and capacity as scheduled on Drawings.

B. Unit Heater Vent:
1. Category I, II, III, IV.
2. UL listed.
3. Double-wall:
   a. Stainless steel inner wall.
   b. 409 stainless steel outer wall.
4. Factory built-in silicone seal.
5. Insulating space: Air.
6. Approved by local Building Codes.
7. Provide screened vent cap.

C. Wall-Mounted Centrifugal Exhaust Fans:
1. AMCA certified.
2. Non-overloading horsepower capabilities.
3. Materials:
   a. Housing: Spun aluminum.
   b. Wheel: Aluminum.
   c. Drive shaft: Stainless steel.
   d. Minimum 10 GA motor mounting plate.
5. Statically and dynamically balanced wheel.
6. Bearings:
   a. Cast iron pillow blocks.
   b. Concentric bearing locking collar for drive shafts 1 IN and larger.
      1) SKF "ConCentra."
      2) Dodge "D Lock."
   c. Regreaseable.
   d. 200,000 HR average life.
7. Weathertight compartment for motor and drives.
   a. Separated from airstream.
8. Motor:
   a. See Specification Section 11005.
   b. Driver and driven sheaves:
      1) Keyed hub type.
      2) Drive sheaves: Fixed pitch diameter.
      3) Driver:
         a. Shipped with variable pitch diameter sheave.
         b. Fixed pitch diameter size based on approved test and balance reports.
         4) V-belt drives sized for 150 percent motor horsepower.
11. Integral attachment collar.
12. Accessories:
   a. Aluminum birdscreen.
   c. Extended grease lines and fittings.
13. Size and capacity as scheduled on Drawings.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with Specification Section 11005.

3.2 FIELD QUALITY CONTROL

A. Comply with Specification Section 11005.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: HVAC ductwork and accessories.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 10200 - Louvers and Vents.
   4. Section 11005 - Equipment: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
      a. 52, Method of Testing Air Conditioning Devices Used in General Ventilation for
         Removing Particulate Matter.
   3. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
      b. HVAC Duct Construction Standards - Metal and Flexible.
   4. Building Code:
      a. International Code Council (ICC):
         amendments, referred to herein as Building Code.

B. Qualifications:
   1. Fabricator: Firms regularly engaged in the manufacture of the specific product, of type, size
      required, whose products have been in use in similar service for not less than three (3) years.
   2. Installers: Firm with at least five (5) years installation experience on products similar to that
      required for this Project.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at
      the Project site.
   2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. See Specification Section 11005.
   3. Efficiency ratings per ASHRAE 52 for factory built and assembled filter units.
   4. Scaled ductwork drawings (1/4 IN equals 1 FT) showing duct and accessory layout and
      support.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01342 for requirements for:
      a. The mechanics and administration of the submittal process.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Transverse joints (factory fabricated aluminum):
      a. Ductmate Industries, Inc.
   2. Air filters:
      b. Farr.
      c. Continental.
   3. Louvers:
      a. Ruskin.
      b. Air Balance.
      c. American Warming.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 COMPONENTS

A. Duct and Fittings (Metallic):
   2. Fabrication:
      a. Minimum sheet material thickness:
         1) Ducts with largest side or diameter to 30 IN: 0.05 IN thick.
         2) Ducts with largest side or diameter greater than 30 IN: 0.08 IN thick.
      b. Utilize SMACNA HVAC Duct Construction Standards for minimum of 2 IN water gage static pressure for the minimum sheet material thickness specified herein.
         1) Heavier gage sheet material may be used with associated reinforcement as an alternate to minimum thickness specified.
         2) Lighter gage sheet material with associated reinforcement shall not be used as an alternate to minimum thickness specified.
      c. Longitudinal seams:
         1) 0.050 material:
            a) Pittsburgh seam.
            b) Continuously welded.
         2) 0.080 material: Continuously welded.
      d. Continuously weld seams on factory assembled units.
      e. Transverse joints (Alternate A):
         1) SMACNA T-22 companion flange.
         2) Gasketed.
      3) Rigidity class:
         a) Ducts with largest side or diameter to 30 IN: SMACNA Class D (1-1/2 x 1-1/2 x 1/8 IN angles).
         b) Ducts with largest side or diameter greater than 30 to 54 IN: SMACNA Class H (2-1/2 x 2-1/2 x 3/16 IN angles).
      f. Transverse joints (Alternate B):
         1) Materials and fabrication:
            a) Angles: Aluminum.
               (1) Ductmate 35.
b) Corners: Aluminum.
   (1) Ductmate DC 35.
c) Snap cleats: Aluminized or stainless steel.
d) Gaskets: Closed cell neoprene.
e) Bolts: Stainless steel.
f) Sheet metal screws: Self-drilling stainless steel with unthreaded section under head.

2) Fabrication:
   a) Rigidity class: SMACNA Class H.
   b) 3/8 IN DIA x 1 IN bolts.

B. Supports and Hangers:
1. Materials:
   a. Support angles: Aluminum or stainless steel.
   b. Hanger rods: Stainless steel.
   c. Anchors: Stainless steel wedge type.
2. Fabrication: Trapeze type units.

C. Turning Vanes:
1. Materials: Same as duct.
2. Fabrication:
   a. Fabricate double vane units.
   b. Pressure drop through elbows: Maximum 20 percent of velocity pressure.

D. Air Filters:
1. Materials:
   a. Holding frame: Aluminum.
2. Fabrication:
   a. Factory built and assembled unit.
   b. MERV 8 efficiency rating as per ASHRAE 52.
   c. 2 IN thickness minimum.
   d. Air velocity: 450 FPM maximum.
   e. Clean pressure drop: 0.2 IN WG maximum.
   f. Size, capacity, and type: As indicated on Drawings.
   g. Provide filter frame assembly at louver opening with clip-in style fasteners.

E. Louvers:
1. Stormproof.
2. Continuous blade appearance.
3. ASTM B221 extruded aluminum, alloy 6063T5, minimum 0.081 IN thick.
4. Minimum free area: As scheduled.
5. Maximum pressure drop: 0.10 IN of water at 900 fpm at zero water penetration.
6. Bird screen:
   a. 1/2 IN SQ mesh.
   b. 16 GA aluminum.
   c. Install in standard, folded frame.
7. Anchors, fasteners, reinforcing: Aluminum or stainless steel.
8. Finish:
   a. Meet requirements of AAMA 2605.
   a. Submit standard color samples for Architect review.

2.3 MAINTENANCE MATERIALS

A. Extra Materials:
1. Furnish Owner with the following extra materials:
   a. Twelve complete filter media changes for each filter unit.
   b. Filter media used during construction is in addition to this requirement.
PART 3 - EXECUTION

3.1 INSTALLATION

A. See Specification Section 11005.

B. Metal Ductwork:
1. Install with longitudinal seams sealed for zero leakage.
   a. For welded seams, submit sample for approval by Engineer.
2. Install gaskets at each transverse joint and fasten sections together with bolts.
   a. Tighten for zero leakage.
3. Install supports and hangers with anchors in accordance with SMACNA HVAC Duct Construction Standards.
4. Install turning vanes in square elbows:
   a. Unsupported vane length not to exceed 48 IN.
   b. Position vanes at proper angle to meet specified pressure drop.
5. Install flexible connections at fans:
   a. Locate as close as possible to fan.
   b. Allow 1 IN of slack to prevent vibration transmission.
   c. Install thrust restraints across connectors.
6. Install access doors where indicated on Drawings and at smoke and fire damper in accordance with NFPA requirements.
7. Volume extractors:
   a. Install at supply registers, grilles, diffusers and supply branch connections from ducts.
   b. Provide branch duct extensions into main duct above and below extractor when branch duct is narrower than main duct.

C. Air Filters:
1. Install where shown on Drawings of size and capacity scheduled on Drawings.
2. Do not operate equipment during construction without filters.

END OF SECTION
SECTION 15990
HVAC SYSTEMS: BALANCING AND TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Adjusting, balancing, and testing of all heating, ventilating and air conditioning (HVAC) systems, including the following systems:
      a. Air distribution and exhaust systems.
      b. Heating system.

B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   4. Section 15890 - HVAC: Ductwork.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Associated Air Balance Council (AABC):
   2. American Industrial Hygiene Association (AIHA):
      a. Z9.5, Laboratory Ventilation.
   3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
      a. HVAC Applications Handbook, Chapter entitled "Laboratories."
   4. National Environmental Balancing Bureau (NEBB):

B. Qualifications:
   1. Work of this Section to be accomplished by an independent testing and balancing firm certified by one (1) of the following:
      a. Associated Air Balance Council (AABC).
      b. National Environmental Balancing Bureau (NEBB).
      c. Other certification entity approved by Engineer.
   2. The independent firm shall not be the same firm as the firm installing the HVAC equipment, nor under contract to the firm installing the equipment.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.

   2. Certifications:
      a. Letter stating the name and qualifications of the firm proposed.
      b. Evidence that relevant subcontractors have been notified of the requirement to coordinate balance and test elements in the work with the testing and balancing firm.

   3. Report forms:
      a. Procedures and forms to be used in calibrating of test instruments, balancing systems, and recording and reporting test data.
B. Informational Submittals:
   1. Completed test reports and data forms upon completion of installation, balance and testing
      of HVAC systems.
      a. Insert recorded information on report forms required by specifications and approved for
         use on project.
      b. Additional written verification and other related information clearly identifying project,
         date and specifics of verification.
      c. Utilize report forms similar to those shown in Section V of AABC Standard.
      d. Provide forms typed and signed by the testing and balancing firm.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 PREPARATION

A. Secure approved Shop Drawings of all HVAC equipment.

B. Procedures and Forms:
   1. Submit procedures and forms to be used in calibration of test instruments, balancing
      systems, and recording and reporting test data.
   2. Obtain approval before beginning balancing and testing.

C. Do not begin balancing and testing until HVAC systems are complete and in full working order.
   1. Place HVAC systems into full operation and continue their operation during each working
      day of balancing and testing.

D. Provide qualified heating and ventilating Engineer(s) to supervise and perform balancing and
   testing.

E. Review design Drawings, Specifications, approved Shop Drawings and other related items to
   become thoroughly acquainted with the design of HVAC systems.

F. Check all installed systems against Contract Drawings, Specifications and Shop Drawings to see
   that system is installed as required.
   1. Report deficiencies to the Engineer.
   2. Report deficiencies to Contractor for remedial action including providing corrective
      measures required in the function of any part of system to complete balancing.

G. Make necessary adjustments as required to balance the systems.

3.2 FIELD QUALITY CONTROL

A. Balance and Test Air Systems:
   1. Adjust equipment RPM to design requirements.
   3. Obtain design CFM at fans.
      a. Make pitot tube traverse of main supply and exhaust ducts within 5 percent.
   4. Test and record system static pressures, suction and discharge.
   5. Obtain design CFM for recirculated air.
   6. Obtain design CFM outside air.
   7. Test and record entering air temperatures, (DB).
   8. Test and record leaving air temperatures, (DB).
   9. Adjust dampers in supply, exhaust and return air ducts to design CFM.
   10. Test diffusers, grilles, and registers and openings as follows:
      a. Adjust to comply with design requirements within 10 percent.
      b. Identify location and area of each.
c. Adjust face velocity to establish required CFM.
   1) Retest after initial adjustments.
   d. Adjust to minimize drafts and to ensure uniform air distribution in all areas.
11. Identify and list size, type and manufacturer of diffusers, grilles, registers, and HVAC equipment.
   a. Use manufacturer's ratings on equipment to make required calculations.
12. Adjust and assure that the operation of automatically operated dampers are as specified.
   a. Check and calibrate controls.
13. Prepare and submit reports.

END OF SECTION
SECTION 16010
ELECTRICAL: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes: Basic requirements for electrical systems.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 05505 - Metal Fabrications.
   4. Section 10400 - Identification Devices.
   5. Section 16120 - Wire and Cable - 600 Volt and Below.
   6. Section 16130 - Raceways and Boxes.
   7. Section 11005 - Equipment: Basic Requirements.

1.2 QUALITY ASSURANCE
A. Referenced Standards:
   1. Aluminum Association (AA).
   3. ASTM International (ASTM):
         and Steel Products.
         Hardware.
   4. ETL Testing Laboratories (ETL).
   5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   6. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      a. 70, National Electrical Code (NEC).
   8. Underwriters Laboratories, Inc. (UL).
B. Where UL test procedures have been established for the product type, use UL or ETL approved
   electrical equipment and provide with the UL or ETL label.

1.3 DEFINITIONS
A. For the purposes of providing materials and installing electrical work the following definitions
   shall be used.
   1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather
      and including below grade structures, such as vaults, manholes, handholes and in-ground
      pump stations.
   2. Architecturally finished interior area: Offices, laboratories, conference rooms, restrooms,
      corridors and other similar occupied spaces.
   3. Non-architecturally finished interior area: Pump, chemical, mechanical, electrical rooms
      and other similar process type rooms.
   4. Highly corrosive and corrosive area: Areas identified on the Drawings where there is a
      varying degree of spillage or splashing of corrosive materials such as water, wastewater or
      chemical solutions; or chronic exposure to corrosive, caustic or acidic agents, chemicals,
      chemical fumes or chemical mixtures.
5. Hazardous areas: Class I, II or III areas as defined in NFPA 70.
6. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01340 for requirements for the mechanics and administration of submittal process.
2. See Specification Section 11005 and individual specification sections for submittal requirements for products defined as equipment.
3. General requirements:
   a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.
   b. Include data sheets that include manufacturer's name and product model number.
   1) Clearly identify all optional accessories.
   c. Acknowledgement that products are UL or ETL listed or are constructed utilizing UL or ETL recognized components.
   d. Manufacturer's delivery, storage, handling and installation instructions.
   e. Product installation details.
   f. See individual specification sections for any additional requirements.

B. Operation and Maintenance Manuals:
1. See Specification Section 01342 for requirements for:
   a. The mechanics and administration of the submittal process.
   b. The content process of Operation and Maintenance Manuals.

C. When a Specification Section includes products specified in another Specification Section, each Specification Section shall have the required Shop Drawing transmittal form per Specification Section 01340 and all Specification Sections shall be submitted simultaneously.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 01600.
B. Protect nameplates on electrical equipment to prevent defacing.

1.6 AREA DESIGNATIONS

A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.
1. Outdoor areas:
   a. Wet.
   b. Also, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.
2. Indoor areas:
   a. Dry.
   b. Also, wet, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to specific Division 26 Specification Sections and specific material paragraphs below for acceptable manufacturers.
B. Submit request for substitution in accordance with Specification Section 01640.
C. Provide all components of a similar type by one (1) manufacturer.
2.2 MATERIALS

A. Electrical Equipment Support Pedestals and/or Racks:
   1. Approved manufacturers:
      a. Modular strut:
         1) Unistrut Building Systems.
         2) Eaton B-Line.
         3) Globe Strut.
         4) Thomas & Betts Superstrut.
   2. Material requirements:
      a. Modular strut:
         1) Aluminum: AA Type 6063-T6.
      b. Mounting hardware:
         1) Stainless steel.
      c. Anchorage per Specification Section 05505.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and wire all equipment, including prepurchased equipment, and perform all tests
   necessary to assure conformance to the Drawings and Specification Sections and ensure that
   equipment is ready and safe for energization.
B. Install equipment in accordance with the requirements of:
   1. NFPA 70.
   2. IEEE C2.
   3. The manufacturer's instructions.
C. In general, conduit routing is not shown on the Drawings.
   1. The Contractor is responsible for routing all conduits including those shown on one-line and
      control block diagrams and home runs shown on floor plans.
   2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be
      as required for equipment furnished and field conditions.
D. When complete branch circuiting is not shown on the Drawings:
   1. A homerun indicating panelboard name and circuit number will be shown and the circuit
      number will be shown adjacent to the additional devices (e.g., light fixture and receptacles)
      on the same circuit.
   2. The Contractor is to furnish and install all conduit and conductors required for proper
      operation of the circuit.
   3. The indicated home run conduit and conductor size shall be used for the entire branch
      circuit.
   4. See Specification Section 16120 for combining multiple branch circuits in a common
      conduit.
E. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or
   as required by the NFPA 70.
F. Install equipment plumb, square and true with construction features and securely fastened.
G. Install electrical equipment, including pull and junction boxes, minimum of 6 IN from process,
   gas, air and water piping and equipment.
H. Install equipment so it is readily accessible for operation and maintenance, is not blocked or
   concealed and does not interfere with normal operation and maintenance requirements of other
   equipment.
I. Device Mounting Schedule:
   1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:
      a. Light switch (to center): 48 IN.
      b. Receptacle in architecturally finished areas (to center): 18 IN.
      c. Receptacle on exterior wall of building (to center): 18 IN.
      d. Receptacle in non-architecturally finished areas (to center): 48 IN.
      e. Telephone outlet in architecturally finished areas (to center): 18 IN.
      f. Telephone outlet for wall-mounted phone (to center): 54 IN.
      g. Safety switch (to center of operating handle): 54 IN.
      h. Separately mounted motor starter (to center of operating handle): 54 IN.
      i. Pushbutton or selector switch control station (to center): 48 IN.
      j. Panelboard (to top): 72 IN.

J. Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades.
   1. When it is necessary to adjust the intended location of electrical equipment, unless specifically dimensioned or detailed, the Contractor may make adjustments in equipment locations in accordance with the following without obtaining the Engineer's approval:
      a. 1 FT at grade, floor and roof level in any direction in the horizontal plane.
      b. 1 FT for equipment other than lighting at ceiling level in any direction in the horizontal plane.
      c. 1 FT for lighting fixtures at ceiling level in any direction in the horizontal plane.
      d. 1 FT on walls in a horizontal direction within the vertical plane.
      e. Changes in equipment location exceeding those defined above require the Engineer's approval.

K. Provide electrical equipment support system per the following area designations:
   1. Dry areas:
      a. Aluminum system consisting of aluminum channels and fittings with stainless steel nuts and hardware.
   2. Wet areas:
      a. Aluminum system consisting of aluminum channels and fittings with stainless steel nuts and hardware.
   3. Corrosive areas:
      a. Aluminum system consisting of aluminum channels and fittings with stainless steel nuts and hardware.

L. Provide all necessary anchoring devices and supports rated for the equipment load based on dimensions and weights verified from approved submittals, or as recommended by the manufacturer.
   1. See Specification Section 05505.
   2. Do not cut, or weld to, building structural members.
   3. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.

M. Provide corrosion resistant spacers to maintain 1/4 IN separation between metallic equipment and/or metallic equipment supports and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Basins, Clarifiers, Digesters, Reservoirs, etc.

N. Do not place equipment fabricated from aluminum in direct contact with earth or concrete.

O. Screen or seal all openings into equipment mounted outdoors to prevent the entrance of rodents and insects.

P. Do not use materials that may cause the walls or roof of a building to discolor or rust.

Q. Identify electrical equipment and components in accordance with Specification Section 10400.
3.2 FIELD QUALITY CONTROL

A. Verify exact rough-in location and dimensions for connection to electrified equipment, provided by others.
   1. See Specification Section 01800 for openings and penetrations in structures.

B. Replace equipment and systems found inoperative or defective and re-test.

C. Cleaning: See Specification Section 01710.

D. The protective coating integrity of support structures and equipment enclosures shall be maintained.
   1. Repair galvanized components utilizing a zinc rich paint.
   2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
   3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the component.
   4. Repair surfaces which will be inaccessible after installation prior to installation.
   5. See Specification Section 16130 for requirements for conduits and associated accessories.

E. Replace nameplates damaged during installation.

3.3 DEMONSTRATION

A. Demonstrate equipment in accordance with Specification Section 01650.

END OF SECTION
SECTION 16060
GROUNDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Material and installation requirements for grounding system(s).

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 10400 - Identification Devices.
   4. Section 16010 - Electrical: Basic Requirements.
   5. Section 16120 - Wire and Cable - 600 Volt and Below.
   6. Section 16130 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard,
         Medium-Hard, or Soft.
   2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. 837, Standard for Qualifying Permanent Connections Used in Substation Grounding.
      a. 70, National Electrical Code (NEC).
         1) Article 250, Grounding and Bonding.
         2) Article 610, Cranes and Hoists.
         3) Article 620, Elevators, Dumbwaiters, Escalators, Moving Walks, Platform Lifts,
            and Stairway Chairlifts.
   4. Underwriters Laboratories, Inc. (UL):
      a. 467, Grounding and Bonding Equipment.

B. Assure ground continuity is continuous throughout the entire Project.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Product technical data.
      a. Provide submittal data for all products specified in PART 2 of this Specification
         Section except:
         1) Grounding clamps, terminals and connectors.
         2) Exothermic welding system.
      b. See Specification Section 16010 for additional requirements.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Ground rods and bars and grounding clamps, connectors and terminals:
      a. Burndy.
      b. Harger Lightning Protection.
      c. Heary Brothers.
      d. Joslyn.
      e. Robbins Lightning Protection.
      f. Thomas & Betts Blackburn.
      g. Thompson.
   2. Exothermic weld connections:
      b. Harger Lightning Protection.
      c. Thermoweld.
      d. Thomas & Betts Furseweld.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 COMPONENTS

A. Wire and Cable:
   2. Insulated conductors: Color coded green, per Specification Section 16120.

B. Conduit: As specified in Specification Section 16130.

C. Ground Rods:
   1. 3/4 IN x 10 FT, or as indicated on the Drawings.
   2. Copperclad:
      a. Heavy uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
      b. Corrosion resistant bond between the copper and steel.
      c. Hard drawn for a scar-resistant surface.

D. Grounding Clamps, Connectors and Terminals:
   1. Mechanical type:
      b. High copper alloy content.
   2. Compression type for interior locations:
      b. High copper alloy content.
      c. Non-reversible.
      d. Terminals for connection to bus bars shall have two bolt holes.
   3. Compression type suitable for direct burial in earth or concrete:
      b. High copper alloy content.
      c. Non-reversible.

E. Exothermic Weld Connections:
   1. Copper oxide reduction by aluminum process.
   2. Molds properly sized for each application.
PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install products in accordance with manufacturer's instructions.
2. Size grounding conductors and bonding jumpers in accordance with NFPA 70, Article 250, except where larger sizes are indicated on the Drawings.
3. Remove paint, rust, or other non-conducting material from contact surfaces before making ground connections.
4. Where ground conductors pass through floor slabs or building walls provide nonmetallic sleeves and install per Specification Section 01800.
5. Do not splice grounding conductors except at ground rods.
6. Install ground rods and grounding conductors in undisturbed, firm soil.
   a. Provide excavation required for installation of ground rods and ground conductors.
   b. Use driving studs or other suitable means to prevent damage to threaded ends of sectional rods.
   c. Unless otherwise specified, connect conductors to ground rods with compressor type connectors or exothermic weld.
   d. Provide sufficient slack in grounding conductor to prevent conductor breakage during backfill or due to ground movement.
   e. Backfill excavation completely, thoroughly tamping to provide good contact between backfill materials and ground rods and conductors.
7. Do not use exothermic welding if it will damage the structure the grounding conductor is being welded to.

B. Grounding Electrode System:
1. Provide a grounding electrode system in accordance with NFPA 70, Article 250 and as indicated on the Drawings.
2. Grounding conductor terminations:
   a. Ground bars in electrical equipment, use compression type terminal and bolt it to the ground bar.
   b. Piping systems use mechanical type connections.
   c. Building steel, below grade and encased in concrete, use compression type connector or exothermic weld.
   d. At all above grade terminations, the conductors shall be labeled per Specification Section 10400.
3. Triad grounding system:
   a. Triad consists of three ground rods arranged in a triangle separated by 10 FT and a grounding conductor interconnecting each ground rod.
   b. Place first ground rod a minimum of 10 FT from the structure foundation and 2 FT-6 IN below grade.
   c. Grounding conductor: Bare conductor, size as indicated on the Drawings.

C. Low Voltage Transformer Separately Derived Grounding System:
1. Ground separately mounted step-down transformers XO terminal to one of the following:
   a. Closest building steel using mechanical type terminal bolted to the steel, compression type connection or exothermic weld.
   b. Closest water pipe using a mechanical type connection.

D. Raceway Bonding/Grounding:
1. All metallic conduit shall be installed so that it is electrically continuous.
2. All conduits to contain a grounding conductor with insulation identical to the phase conductors, unless otherwise indicated on the Drawings.
3. NFPA 70 required grounding bushings shall be of the insulating type.
4. Provide double locknuts at all panels.
5. Bond all conduit, at entrance and exit of equipment, to the equipment ground bus or lug.
6. Provide bonding jumpers if conduits are installed in concentric knockouts.
7. Make all metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.

E. Equipment Grounding:
   1. All utilization equipment shall be grounded with an equipment ground conductor.

3.2 FIELD QUALITY CONTROL

A. Leave grounding system uncovered until observed by Owner.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Material and installation requirements for:
   a. Building wire.
   b. Control cable.
   c. Wire connectors.
   d. Insulating tape.
   e. Pulling lubricant.

B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 16010 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
1. Insulated Cable Engineers Association (ICEA):
2. National Electrical Manufacturers Association (NEMA):
   a. ICS 4, Industrial Control and Systems: Terminal Blocks.
3. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA):
   a. WC 57/S-73-532, Standard for Control Cables.
   a. 70, National Electrical Code (NEC).
5. Underwriters Laboratories, Inc. (UL):
   c. 467, Standard for Safety Grounding and Bonding Equipment.
   d. 486A, Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors.
   e. 486C, Standard for Safety Splicing Wire Connections.
   f. 510, Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
   g. 1277, Standard for Safety Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
   i. 2250, Standard for Safety Instrumentation Tray Cable.

1.3 DEFINITIONS

A. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.
B. Control Cable: Multi-conductor, insulated, with outer sheath containing building wires, No. 14, No. 12 or No. 10 AWG.
C. Building Wire: Single conductor, insulated, with or without outer jacket depending upon type.
1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification
         Section except:
         1) Wire connectors.
         2) Insulating tape.
         3) Cable lubricant.
      b. See Specification Section 16010 for additional requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

   A. See Specification Section 16010.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are
   acceptable:
   1. Building wire and control cable:
      a. Aetna Insulated Wire.
      b. Alphawire.
      c. Cerrowire.
      d. Encore Wire Corporation.
      e. General Cable.
      f. Okonite Company.
      g. Southwire Company.
   2. Wire connectors:
      a. Burndy Corporation.
      b. Buchanan.
      c. Ideal.
      d. Ilsco.
      e. 3M Co.
      f. Teledyne Penn Union.
      g. Thomas and Betts.
      h. Phoenix Contact.
   3. Insulating and color coding tape:
      a. 3M Co.
      b. Plymouth Bishop Tapes.
      c. Red Seal Electric Co.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MANUFACTURED UNITS

A. Building Wire:
   1. Conductor shall be copper with 600 V rated insulation.
   2. Conductors shall be stranded, except for conductors used in lighting and receptacle circuits
      which may be stranded or solid.
   3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and
      UL label.
   4. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 for type THHN/THWN and
      THHN/THWN-2 insulation.
5. Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW-2 insulation.

B. Control Cable:
1. Conductor shall be copper with 600 V rated insulation.
2. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
3. Conform to NEMA/ICEA WC 57/S-73-532 and UL 83 and UL 1277 for type THHN/THWN insulation with an overall PVC jacket.
4. Number of conductors as required, provided with or without bare ground conductor of the same AWG size.
   a. When a bare ground conductor is not provided, an additional insulated conductor shall be provided and used as the ground conductor (e.g., 6/c No. 14 w/g and 7/c No. 14 are equal).
5. Individual conductor color coding:
   a. ICEA S-58-679, Method 1, Table E-2.
   b. See PART 3 of this Specification Section for additional requirements.
6. Conform to NFPA 70 Type TC.

C. Electrical Equipment Control Wire:
1. Conductor shall be copper with 600 V rated insulation.
2. Conductors shall be stranded.
3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
4. Conform to UL 44 for Type SIS insulation.
5. Conform to UL 83 for Type MTW insulation.

D. Wire Connectors:
1. Twist/screw on type:
   a. Insulated pressure or spring type solderless connector.
   b. 600 V rated.
   c. Ground conductors: Conform to UL 486C and/or UL 467 when required by local codes.
   d. Phase and neutral conductors: Conform to UL 486C.
2. Compression and mechanical screw type:
   a. 600 V rated.
   b. Ground conductors: Conform to UL 467.
   c. Phase and neutral conductors: Conform to UL 486A.
3. Terminal block type:
   a. High density, screw-post barrier-type with white center marker strip.
   b. 600 V and ampere rating as required, for power circuits.
   c. 600 V, 20 ampere rated for control circuits.
   d. 300 V, 15 ampere rated for instrumentation circuits.
   e. Conform to NEMA ICS 4 and UL 486A.

E. Insulating and Color Coding Tape:
1. Pressure sensitive vinyl.
2. Premium grade.
3. Heat, cold, moisture, and sunlight resistant.
4. Thickness, depending on use conditions: 7, 8.5, or 10 mil.
5. For cold weather or outdoor location, tape must also be all-weather.
6. Color:
   a. Insulating tape: Black.
   b. Color coding tape: Fade-resistant color as specified herein.
7. Comply with UL 510.

F. Pulling Lubricant: Cable manufacturer's standard containing no petroleum or other products which will deteriorate insulation.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Permitted Usage of Insulation Types:

1. Type XHHW-2:
   a. Building wire and control cable in architectural and non-architectural finished areas.
   b. Building wire and control cable in conduit below grade.

2. Type THHN/THWN and THHN/THWN-2:
   a. Building wire and control cable No. 8 AWG and smaller in architectural and non-architectural finished areas.

3. Type SIS and MTW:
   a. For the wiring of control equipment within control panels and field wiring of control equipment within switchgear, switchboards, motor control centers.

B. Conductor Size Limitations:

1. Feeder and branch power conductors shall not be smaller than No. 12 AWG unless otherwise indicated on the Drawings.

2. Control conductors shall not be smaller than No. 14 AWG unless otherwise indicated on the Drawings.

3. Instrumentation conductors shall not be smaller than No. 18 AWG unless otherwise indicated on the Drawings.

C. Color Code All Wiring as Follows:

1. Building wire:

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Neutral</th>
<th>Ground</th>
</tr>
</thead>
<tbody>
<tr>
<td>240 V, 208 V</td>
<td>Black</td>
<td>Red *</td>
<td>Blue</td>
<td>White</td>
<td>Green</td>
</tr>
<tr>
<td>240/120 V, 208/120 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>480 V, 480/277 V</td>
<td>Brown</td>
<td>Orange</td>
<td>Yellow</td>
<td>White or Gray</td>
<td>Green</td>
</tr>
</tbody>
</table>

* Orange when it is a high leg of a 120/240 V Delta system.

a. Conductors No. 6 AWG and smaller: Insulated phase, neutral and ground conductors shall be identified by a continuous colored outer finish along its entire length.

b. Conductors larger than No. 6 AWG:
   1) Insulated phase and neutral conductors shall be identified by one (1) of the following methods:
      a) Continuous colored outer finish along its entire length.
      b) 3 IN of colored tape applied at the termination.
   2) Insulated grounding conductor shall be identified by one (1) of the following methods:
      a) Continuous green outer finish along its entire length.
      b) Stripping the insulation from the entire exposed length.
      c) Using green tape to cover the entire exposed length.
   3) The color coding shall be applied at all accessible locations, including but not limited to: Junction and pull boxes, wireways, manholes and handholes.

2. Control cables ICEA S-58-679, Method 1, Table E-2:
   a. When a bare ground is not provided, one (1) of the colored insulated conductors shall be re-identified by stripping the insulation from the entire exposed length or using green tape to cover the entire exposed length.
   b. When used in power applications the colored insulated conductors used as phase and neutral conductors may have to be re-identified with 3 IN of colored tape, per the Table herein, applied at the terminations.
D. Install all wiring in raceway unless otherwise indicated on the Drawings.

E. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:
1. Where specifically indicated on the Drawings.
2. Where field conditions dictate and written permission is obtained from the Engineer.
3. Control circuits shall be isolated from feeder and branch power and instrumentation circuits but combining of control circuits is permitted.
   a. The combinations shall comply with the following:
      1) 12 Vdc, 24 Vdc and 48 Vdc may be combined.
      2) 125 Vdc shall be isolated from all other AC and DC circuits.
      3) AC control circuits shall be isolated from all DC circuits.
4. Multiple branch circuits for lighting, receptacle and other 120 Vac circuits are allowed to be combined into a common raceway.
   a. Contractor is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NFPA 70, including but not limited to:
      1) Up sizing conductor size for required ampacity de-ratings for the number of current carrying conductors in the raceway.
      2) The neutral conductors may not be shared.
      3) Up sizing raceway size for the size and quantity of conductors.

F. Ground the drain wire of shielded instrumentation cables at one (1) end only.
   1. The preferred grounding location is at the load (e.g., control panel), not at the source (e.g., field mounted instrument).

G. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method.
1. Feeder and branch power circuits:
   a. Device outlet boxes:
      1) Twist/screw on type connectors.
   b. Junction and pull boxes and wireways:
      1) Twist/screw on type connectors for use on No. 8 and smaller wire.
      2) Compression, mechanical screw or terminal block or terminal strip type connectors for use on No. 6 AWG and larger wire.
   c. Motor terminal boxes:
      1) Twist/screw on type connectors for use on No. 10 AWG and smaller wire.
      2) Insulated mechanical screw type connectors for use on No. 8 AWG and larger wire.
   d. Manholes or handholes:
      1) Twist/screw on type connectors pre-filled with epoxy for use on No. 8 AWG and smaller wire.
      2) Watertight compression or mechanical screw type connectors for use on No. 6 AWG and larger wire.
2. Control circuits:
   b. Manholes or handholes: Twist/screw on type connectors pre-filled with epoxy.
   c. Control panels and motor control centers: Terminal block or strips provided within the equipment or field installed within the equipment by the Contractor.
3. Instrumentation circuits can be spliced where field conditions dictate and written permission is obtained from the Engineer.
   a. Maintain electrical continuity of the shield when splicing twisted shielded conductors.
   b. Junction and pull boxes: Terminal block type connector.
   c. Control panels and motor control centers: Terminal block or strip provided within the equipment or field installed within the equipment by the Contractor.
4. Non-insulated compression and mechanical screw type connectors shall be insulated with tape or hot or cold shrink type insulation to the insulation level of the conductors.
H. Insulating Tape Usage:
   1. For insulating connections of No. 8 AWG wire and smaller: 7 mil vinyl tape.
   2. For insulating splices and taps of No. 6 AWG wire or larger: 10 mil vinyl tape.
   3. For insulating connections made in cold weather or in outdoor locations: 8.5 mil, all
      weather vinyl tape.
I. Color Coding Tape Usage: For color coding of conductors.

   END OF SECTION
SECTION 16125
HEAT TRACING CABLE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Heat tracing cable as required for heat tracing of pipes as indicated on the Drawings.

B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Division 15 - Mechanical.
   4. Section 16010 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Power requirements for each circuit based upon actual length of heat trace and maintained temperature.
      b. Circuit breaker rating based upon inrush current at minimum expected start-up temperature.
      c. Length of heat tape for each pipe size and run.
      d. Coordinate and verify length and Watts/FT of heat tape required based upon pipe size and insulation thickness.
      1) Include the calculations to support the heat tape output.
      e. See Section 16010 for additional requirements.
   3. Fabrication and/or layout Drawings:
      a. Wiring diagrams showing physical locations of thermostats and heat trace power supply.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01342 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

C. Informational Submittals:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Test reports: Megger test results.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Shall be stored such that they are not exposed to sunlight or other UV rays.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   1. Thermon.
   2. Chemelex Division; Raychem Corp.
   3. Chromalox.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 HEAT TRACING

A. Design Parameters:
   1. Pipe diameter, length and material: See Drawings and Division 15 Specifications.
   2. Flange, valve, pipe support size: See Drawings and Division 15 Specifications.
   3. Pipe insulation type and thickness: See Drawings and Division 15 Specifications.
   4. Temperatures requirements:
      a. Low ambient temperature for the specific location: -40 DegF.
      b. Start-up temperature (alarm thermostat set point):
         1) Water/wastewater lines: 40 DegF.
         2) Caustic feed lines: 80 DegF.
      c. Maintain temperature (power thermostat set point):
         1) Water/wastewater lines: 40 DegF.
         2) Caustic feed lines: 80 DegF.
      d. High temperature exposure with power off: 185 DegF.
   5. Wind factor for the specific location: 10 MPH.
   6. Electrical requirements:
      a. Voltage: 120V.
      b. Circuit breaker: Field coordinate if other than 20A GFEPCLI type.
   7. Safety factor: 10 percent.

B. Self-regulating or power-limiting parallel circuit construction consisting of an inner core of conductive material between parallel copper bus wires, with inverse temperature - conductivity characteristics with metal overbraid.

C. Thermostats adjustable between 35 and 200 DegF minimum with maximum differential range of 9 DegF, furnished complete with NEMA 4 enclosures in all areas, stainless steel temperature bulb and capillary.

D. All necessary or required components and accessories, such as power connection boxes, end seals, straps, tape and fitting brackets.

E. In noncorrosive and nonhazardous locations, insulation shall be Polyolefin.

F. In corrosive, hazardous and hydrocarbon locations insulation shall be Fluoropolymer (Teflon).

PART 3 - EXECUTION

3.1 PREPARATION

A. Install materials after piping has been tested and approved.

3.2 INSTALLATION

A. Insulate and heat trace wet pipe systems as indicated on Drawings.

B. Install materials in accordance with manufacturer's instructions.
   1. Each circuit shall not exceed the manufacturer's recommended maximum length.
C. For Metallic Piping:
   1. Heat tracing shall be installed completely wired.
   2. Cut heat trace to lengths as required and secure to pipe with glass or polyester fiber tape.

D. For Nonmetallic Piping:
   1. Allow for extra heat trace output because nonmetallic pipe has a lower heat transfer.
      a. Heat tracing shall be installed completely wired.
   2. Cut heat trace to lengths as required and secure to pipe with aluminum tape throughout the length of the trace.

E. Protection and Control Requirements:
   1. Protection by a GFEPIC circuit breaker.
      a. Breaker amperage rating shall be coordinated with Contractor when different than the Contract Drawings.
   2. Provide two (2) line sensing thermostats, one (1) for power and one (1) for alarm.
   3. The alarm thermostat shall be placed on the opposite end of the circuit from the power thermostat or power connection to allow for annunciation of partial failure of a circuit or the loss of power from a tripped GFEPIC circuit breaker.
   4. Provide a monitoring module that monitors the voltage (circuit breaker status) to each circuit.
   5. The alarm from the alarm thermostat and monitor module shall be annunciated on the indicated control system.

3.3 TESTING

A. Megger the cables at the manufacturers recommended voltage level three (3) times.
   1. Before installation.
   2. After attachment to pipe but before insulation is installed.
   3. After pipe insulation is installed but before energization.

END OF SECTION
SECTION 16130
RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Conduits.
      b. Conduit fittings.
      c. Conduit supports.
      d. Wireways.
      e. Outlet boxes.
      f. Pull and junction boxes.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.
   4. Section 16140 - Wiring Devices.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Iron and Steel Institute (AISI).
   2. ASTM International (ASTM):
         and Steel Products.
         Hardware.
      c. D2564, Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC)
         Plastic Piping Systems.
   3. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
      c. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
      a. 70, National Electrical Code (NEC).
   5. Underwriters Laboratories, Inc. (UL):
      a. 1, Standard for Flexible Metal Conduit.
      b. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
      c. 360, Standard for Liquid-Tight Flexible Steel Conduit.
      d. 467, Grounding and Bonding Equipment.
      e. 514A, Metallic Outlet Boxes.
      f. 514B, Conduit, Tubing, and Cable Fittings.
      g. 651, Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings.
      h. 886, Standard for Outlet Boxes and Fittings for Use in Hazardous (Classified)
         Locations.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
2. Product technical data:
   a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
      1) Conduit fittings.
      2) Support systems.
   b. See Specification Section 16010 for additional requirements.
3. Fabrication and/or layout Drawings:
   a. Identify dimensional size of pull and junction boxes to be used.

1.4 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 16010.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Rigid metallic conduits:
   a. EASCO Aluminum.
   b. Indalex.
   c. VAW of American, Inc.
2. Rigid nonmetallic conduit:
   a. Prime Conduit (Carlon).
   b. Cantex.
   c. Osburn Associates.
3. Flexible conduit:
   a. AFC Cable Systems.
   b. Anamet, Inc.
   c. Electri-Flex.
   d. Flexible Metal Hose Company.
   e. International Metal Hose Company.
   f. Triangle PWC Inc.
   g. LTV Steel Company.
4. Conduit fittings and accessories:
   a. Appleton Electric Co.
   b. Carlon.
   c. Cantex.
   d. Crouse-Hinds.
   e. Killark.
   f. Osburn Associates.
   g. OZ Gedney Company.
   h. RACO.
   i. Steel City.
   j. Thomas & Betts.
5. Support systems:
   b. Eaton B-Line.
   c. Kindorf.
   d. Minerallac Fastening Systems.
   e. Caddy.
   f. Thomas & Betts Superstrut.
6. Outlet, pull and junction boxes:
   a. Appleton Electric Co.
   b. Eaton Crouse-Hinds.
   c. Killark.
1. O-Z/Gedney.
2. Thomas & Betts Steel City.
3. Raco.
4. Bell.
6. Wiegmann.
8. Adalet.
9. Rittal.
m. Stahlin.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 RIGID METALLIC CONDUITS

A. Rigid Aluminum Conduit (RAC):
1. AA Type 6063 aluminum alloy, T-1 temper.
2. Maximum copper content of 0.10 percent.
3. Extruded, seamless.

2.3 RIGID NONMETALLIC CONDUIT

A. Schedules 40 (PVC-40) and 80 (PVC-80):
1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.
2. Rated for direct sunlight exposure.
3. Fire retardant and low smoke emission.
4. Shall be suitable for use with 90 DegC wire and shall be marked "maximum 90 DegC".
5. Standards: NEMA TC 2, UL 651.

2.4 FLEXIBLE CONDUIT

A. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):
1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
2. Extruded PVC outer jacket positively locked to the steel core.
3. Liquid and vapor tight.

2.5 CONDUIT FITTINGS AND ACCESSORIES

A. Fittings for Use with RAC:
1. General:
   a. In hazardous locations listed for use in Class I, Groups C and D locations.
2. Locknuts:
   a. Threaded steel or malleable iron.
   b. Gasketed or non-gasketed.
   c. Grounding or non-grounding type.
3. Bushings:
   a. Threaded, insulated metallic.
   b. Grounding or non-grounding type.
4. Hubs: Threaded, insulated and gasketed metallic for raintight connection.
5. Couplings:
   a. Threaded straight type: Same material and finish as the conduit with which they are used on.
   b. Threadless type: Gland compression or self-threading type, concrete tight.
6. Unions: Threaded galvanized steel or zinc plated malleable iron.
7. Conduit bodies (ells and tees):
8. Conduit bodies (round):
   a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
   b. Cover: Threaded screw on type, gasketed, cast copper free aluminum.

9. Sealing fittings:
   b. Standard and mogul size.
   c. With or without drain and breather.
   d. Fiber and sealing compound: UL listed for use with the sealing fitting.

10. Expansion/deflection couplings:
    a. 3/4 IN nominal straight-line conduit movement in either direction.
    b. 30-degree nominal deflection from the normal in all directions.
    c. Metallic hubs, neoprene outer jacket and stainless steel jacket clamps.
    d. Internally or externally grounded.
    e. Watertight, raintight and concrete tight.


B. Fittings for Use with FLEX-LT:
   1. Connector:
      a. Straight or angle type.
      b. Metal construction, insulated and gasketed.
      c. Composed of locknut, grounding ferrule and gland compression nut.
      d. Liquid tight.

   2. Standards: UL 467, UL 514B.

C. Fittings for Use with Rigid Nonmetallic PVC Conduit:
   1. Coupling, adapters and conduit bodies:
      a. Same material, thickness, and construction as the conduits with which they are used.
      b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.
      c. Bore smooth and free of blisters, nicks or other imperfections which could damage the
         conductor.

   2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the
      conduit and fittings.

   3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B.

D. Weather and Corrosion Protection Tape:
   1. PVC based tape, 10 mils thick.
   2. Protection against moisture, acids, alkalis, salts and sewage and suitable for direct bury.
   3. Used with appropriate pipe primer.

2.6 ALL RACEWAY AND FITTINGS

A. Mark Products:
   1. Identify the nominal trade size on the product.
   2. Stamp with the name or trademark of the manufacturer.

2.7 OUTLET BOXES

A. Metallic Outlet Boxes:
   1. Hot-dip galvanized steel.
   2. Conduit knockouts and grounding pigtail.
   3. Styles:
      a. 2 IN x 3 IN rectangle.
      b. 4 IN square.
      c. 4 IN octagon.
      d. Masonry/tile.
4. Accessories:
   a. Flat blank cover plates.
   b. Barriers.
   c. Extension, plaster or tile rings.
   d. Adjustable bar hangers.
5. Standards: NEMA/ANSI OS 1, UL 514A.

B. Cast Outlet Boxes:
1. Die-cast copper free aluminum with manufacturers standard finish.
2. Threaded hubs and grounding screw.
3. Styles:
   a. "FS" or "FD".
   b. "Bell".
   c. Single or multiple gang and tandem.
   d. "EDS" or "EFS" for hazardous locations.

C. See Specification Section 16140 for wiring devices, wallplates and coverplates.

2.8 PULL AND JUNCTION BOXES

A. NEMA 4X Rated (metallic):
   1. Body and cover: 14 GA Type 304 or 316 stainless steel.
   2. Seams continuously welded and ground smooth.
   3. No knockouts.
   4. External mounting flanges.
   5. Hinged door and stainless steel screws and clamps.
   6. Door with oil-resistant gasket.

B. NEMA 12 Rated:
   1. Body and cover:
      a. Type 5052 H-32 aluminum, unpainted.
   2. Seams continuously welded and ground smooth.
   3. No knockouts.
   4. External mounting flanges.
   5. Non-hinged cover held closed with captivated cover screws threaded into sealed wells or hinged cover held closed with stainless steel screws and clamps.
   6. Flat door with oil resistant gasket.

C. Standards: NEMA 250, UL 50.

2.9 SUPPORT SYSTEMS

A. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:
   1. Material requirements.

B. Single Conduit and Outlet Box Support Fasteners:
   1. Material requirements:
      a. Stainless steel.

2.10 OPENINGS AND PENETRATIONS IN WALLS AND FLOORS

A. Sleeves, smoke and fire stop fitting through walls and floors:
   1. See Specification Section 01800.
PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION - GENERAL

A. Shall be in accordance with the requirements of:
   1. NFPA 70.
   2. Manufacturer instructions.

B. Size of Raceways:
   1. Raceway sizes are shown on the Drawings, if not shown on the Drawings, then size in accordance with NFPA 70.
   2. Unless specifically indicated otherwise, the minimum raceway size shall be:
      a. Conduit: 3/4 IN.

C. Field Bending and Cutting of Conduits:
   1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.
   2. Do not reduce the internal diameter of the conduit when making conduit bends.
   3. Prepare tools and equipment to prevent damage to the PVC coating.
   4. Degrease threads after threading and apply a zinc rich paint.
   5. Debur interior and exterior after cutting.

D. Male threads of conduit systems shall be coated with an electrically conductive anti-seize compound.

E. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.
   1. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
   2. Repair surfaces which will be inaccessible after installation prior to installation.

F. Remove moisture and debris from conduit before wire is pulled into place.
   1. Pull mandrel with diameter nominally 1/4 IN smaller than the interior of the conduit, to remove obstructions.
   2. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
   3. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.

G. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.

H. Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.

I. Fill openings in walls, floors, and ceilings and finish flush with surface.
   1. See Specification Section 01800.

3.2 RACEWAY ROUTING

A. Raceways shall be routed in the field unless otherwise indicated.
   1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.
   2. Run in straight lines parallel to or at right angles to building lines.
   3. Do not route conduits:
      a. Through areas of high ambient temperature or radiant heat.
      b. In suspended concrete slabs.
   4. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
   5. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 degrees of bends in the conduit run or in long straight runs to limit pulling tensions.
B. All rigid conduits within a structure shall be installed exposed except as follows:
   1. As indicated on the Drawings.
   2. Concealed within, poured concrete, concrete block and brick walls for devices and
      equipment mounted in on exterior walls.

C. Maintain minimum spacing between parallel conduit and piping runs in accordance with the
   following when the runs are greater than 30 FT:
   1. Between instrumentation and telecommunication: 1 IN.
   2. Between instrumentation and 125 V, 48 V and 24 Vdc, 2 IN.
   3. Between instrumentation and 600 V and less AC power or control: 6 IN.
   4. Between instrumentation and greater than 600 Vac power: 12 IN.
   5. Between telecommunication and 125 V, 48 V and 24 Vdc, 2 IN.
   6. Between telecommunication and 600 V and less AC power or control: 6 IN.
   7. Between telecommunication and greater than 600 Vac power: 12 IN.
   8. Between 125 V, 48 V and 24 Vdc and 600 V and less AC power or control: 2 IN.
   9. Between 125 V, 48 V and 24 Vdc and greater than 600 Vac power: 2 IN.
  10. Between 600 V and less AC and greater than 600 Vac: 2 IN.
  11. Between process, gas, air and water pipes: 6 IN.

D. Conduits shall be installed to eliminate moisture pockets.
   1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit
      run.

E. Conduit shall not be routed on the exterior of structures except as specifically indicated on the
   Drawings.

F. Provide all required openings in walls, floors, and ceilings for conduit penetration.
   1. See Specification Section 01800.

3.3 RACEWAY APPLICATIONS

A. Permitted Raceway Types Per Wire or Cable Types:
   1. Power wire or cables: All raceway types.
   2. Control wire or cables: All raceway types.

B. Permitted Raceway Types Per Area Designations:
   1. Dry areas: RAC.
   2. Wet areas: RAC.
   3. NFPA 70 hazardous areas: RAC.

C. Permitted Raceway Types Per Routing Locations:
   1. Direct buried conduits and ductbanks:
      a. PVC-40.

D. FLEX-LT conduits shall be install as the final conduit connection to light fixtures, dry type
   transformers, motors, electrically operated valves, instrumentation primary elements, and other
   electrical equipment that is liable to vibrate.
   1. The maximum length shall not exceed:
      a. 6 FT to light fixtures.
      b. 3 FT to motors.
      c. 2 FT to all other equipment.

3.4 CONDUIT FITTINGS AND ACCESSORIES

A. Conduit Seals:
   1. Installed in conduit systems located in hazardous areas as required by the NFPA 70.
   2. Filler plug and drain shall be accessible.
   3. Pour the conduit seals in a two-step process.
      a. Pour the seal and leave cover off.
      b. After seal is dry, inspect for proper sealing, install cover and mark (for example, paint or
         permanent marker) as complete.
B. Rigid nonmetallic conduit and fittings shall be joined utilizing solvent cement.
   1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated
      1/4 turn to provide uniform contact.

C. Install Expansion/Deflection Fittings:
   1. Where conduits enter a structure.
   2. Where conduits span structural expansions joints.

D. Threaded connections shall be made wrench-tight.

E. Conduit joints shall be watertight:
   1. Where subjected to possible submersion.
   2. In areas classified as wet.

F. Terminate Conduits:
   1. In metallic outlet boxes:
      a. RAC:
         1) Conduit hub and locknut.
         2) Insulated bushing and two (2) locknuts.
         3) Use grounding type locknut or bushing when required by NFPA 70.
   2. In NEMA 12 rated enclosures:
      a. Watertight, insulated and gasketed hub and locknut.
      b. Use grounding type locknut or bushing when required by NFPA 70.
   3. In NEMA 4 and NEMA 4X rated enclosures:
      a. Watertight, insulated and gasketed hub and locknut.
   4. In NEMA 7 and NEMA 9 rated enclosures:
      a. Into an integral threaded hub.
      5. When stubbed up through the floor into floor mount equipment:
         a. With an insulated grounding bushing on metallic conduits.
         b. With end bells on nonmetallic conduits.

G. Threadless couplings shall only be used to join new conduit to existing conduit when the
   existing conduit end is not threaded and it is not practical or possible to cut threads on the
   existing conduit with a pipe threader.

3.5 CONDUIT SUPPORT

A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit
types:
   1. Dry or wet and/or hazardous areas:
      a. Aluminum system consisting of: Aluminum channels, fittings and conduit clamps with
         stainless steel nuts and hardware.
   2. Conduit type shall be compatible with the support system material.
      a. Aluminum system may be used with RAC.

B. Permitted single conduit support fasteners per area designations and conduit types:
   1. Dry or wet and/or hazardous areas:
      a. Material: Aluminum or stainless steel.
      b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam
         clamps.

C. Conduit Support General Requirements:
   1. Maximum spacing between conduit supports per NFPA 70.
   2. Support conduit from the building structure.
   3. Do not support conduit from process, gas, air or water piping; or from other conduits.
4. Provide hangers and brackets to limit the maximum uniform load on a single support to 25 LBS or to the maximum uniform load recommended by the manufacturer if the support is rated less than 25 LBS.
   a. Do not exceed maximum concentrated load recommended by the manufacturer on any support.
   b. Conduit hangers:
      1) Continuous threaded rods combined with struts or conduit clamps: Do not use perforated strap hangers and iron bailing wire.
   c. Do not use suspended ceiling support systems to support raceways.
   d. Hangers in metal roof decks:
      1) Utilize fender washers.
      2) Not extend above top of ribs.
      3) Not interfere with vapor barrier, insulation, or roofing.
5. Conduit support system fasteners:
   a. Use sleeve-type expansion anchors as fasteners in masonry wall construction.
   b. Do not use concrete nails and powder-driven fasteners.

3.6 OUTLET, PULL AND JUNCTION BOX INSTALLATION

A. General:
   1. Install products in accordance with manufacturer's instructions.
   2. See Specification Section 16010 and the Drawings for area classifications.
   3. Fill unused punched-out, tapped, or threaded hub openings with insert plugs.
   4. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits connected to the box.

B. Outlet Boxes:
   1. Permitted uses of metallic outlet boxes:
      a. Housing of wiring devices:
         1) Recessed in poured concrete, concrete block and brick walls of exterior building walls.
   2. Permitted uses of cast outlet boxes:
      a. Housing of wiring devices surface mounted in non-architecturally finished dry or wet areas.
   3. Mount device outlet boxes where indicated on the Drawings and at heights as scheduled in Specification Section 16010.
   4. Set device outlet boxes plumb and vertical to the floor.
   5. Outlet boxes recessed in walls:
      a. Locate in ungrouted cell of concrete block with bottom edge of box flush with bottom edge of block and flush with the face of the block.

C. Pull and Junction Boxes:
   1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.
      a. Make covers of boxes accessible.
   2. Permitted uses of NEMA 4X metallic enclosure:
      a. Pull or junction box surface mounted in areas designated as wet.
   3. Permitted uses of NEMA 7 enclosure:
      a. Pull or junction box surface mounted in areas designated as Class I hazardous.
   4. Permitted uses of NEMA 12 enclosure:
      a. Pull or junction box surface mounted in areas designated as dry.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Light switches.
      b. Receptacles.
      c. Device wallplates and coverplates.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.
   4. Section 16130 - Raceways and Boxes.
   5. Section 16442 - Motor Control Equipment.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. WD 1, General Color Requirements for Wiring Devices.
      c. WD 6, Wiring Devices - Dimensional Requirements.
   2. Underwriters Laboratories, Inc. (UL):
      a. 20, General-Use Snap Switches.
      b. 498, Standard for Attachment Plugs and Receptacles.
      c. 514A, Metallic Outlet Boxes.
      d. 894, Standard for Switches for Use in Hazardous (Classified) Locations.
      e. 943, Ground-Fault Circuit-Interrupters.
      f. 1010, Standard for Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. See Specification Section 16010 for additional requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Light switches and receptacles:
      a. Bryant.
b. Eaton Cooper Wiring Devices.
c. Hubbell.
d. Leviton.
e. Pass & Seymour.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 LIGHT SWITCHES

A. General requirements unless modified in specific requirements paragraph of switches per designated areas or types:
1. Toggle type, quiet action, Industrial Specification Grade.
2. Self grounding with grounding terminal.
3. Back and side wired.
4. Solid silver cadmium oxide contacts.
5. Rugged urea housing and one-piece switch arm.
6. Rated 20 A, 120/277 Vac.
7. Switch handle color: Ivory.
8. Types as indicated on the Drawings:

B. Wet Non-architecturally Finished Areas:
1. Coverplate:
   a. Gasketed aluminum with stainless steel screws utilizing rocker, front mounted toggle or pull type switch.
   b. Single or multiple gang as required.

2.3 RECEPTACLES

A. General requirements unless modified in specific requirements paragraph of receptacles per designated areas:
2. Brass triple wipe line contacts.
3. One-piece grounding system with double wipe brass grounding contacts and self grounding strap.
4. Back and side wired.
5. Rated 20 A, 125 Vac.
6. High impact nylon body.
7. Receptacle body color:
   b. Generator or UPS power: Red.
8. Types as indicated on the Drawings:
   a. Normal: Self grounding with grounding terminal.
   b. Ground fault circuit interrupter: Feed-through type with test and reset buttons.
9. Duplex or simplex as indicated on the Drawings.
10. Configuration: NEMA 5-20R.

B. Wet Non-architecturally Finished Areas:
1. Coverplate: Weatherproof (NEMA 3R) while in use, gasketed, copper-free aluminum, 2.5 IN minimum cover depth.

C. Exterior Locations:
1. Coverplate: Weatherproof (NEMA 3R) while in use, gasketed, copper-free aluminum, 2.5 IN minimum cover depth.
2.4 MISCELLANEOUS WIRING DEVICES

A. Manual Motor Starters: Horsepower rated with or without thermal overloads, see Specification Section 16442.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Mount devices where indicated on the Drawings and as scheduled in Specification Section 16010.
C. See Specification Section 16130 for device outlet box requirements.
D. Where more than one (1) receptacle is installed in a room, they shall be symmetrically arranged.
E. Provide blank plates for empty outlets.

END OF SECTION
SECTION 16410
SAFETY SWITCHES

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes: Safety switches.
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.
   4. Section 16490 - Overcurrent and Short Circuit Protective Devices.

1.2 QUALITY ASSURANCE
A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. KS 1, Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
   2. Underwriters Laboratories, Inc. (UL):
      a. 98, Enclosed and Dead-Front Switches.

1.3 SUBMITTALS
A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. Provide a table that associates safety switch model number with connected equipment tag number.
      c. See Specification Section 16010 for additional requirements.
B. Operation and Maintenance Manuals:
   1. See Specification Section 01342 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Subject to compliance with the Contract Documents, the following safety switch manufacturers are acceptable:
   1. Eaton.
   2. General Electric Company.
   4. Siemens.
B. Submit request for substitution in accordance with Specification Section 01640.
2.2 SAFETY SWITCHES

A. General:
   1. Non-fusible or fusible as indicated on the Drawings.
   2. Suitable for service entrance when required.
   3. NEMA Type HD heavy-duty construction.
   4. Switch blades will be fully visible in the OFF position with the enclosure door open.
   5. Quick-make/quick-break operating mechanism.
   6. Deionizing arc chutes.
   7. Manufacture double-break rotary action shaft and switchblade as one (1) common component.
   8. Clear line shields to prevent accidental contact with line terminals.
   9. Operating handle (except NEMA 7 and NEMA 9 rated enclosures):
      a. Red and easily recognizable.
      b. Padlockable in the OFF position.
      c. Interlocked to prevent door from opening when the switch is in the ON position with a defeater mechanism.

B. Ratings:
   1. Horsepower rated of connected motor.
   2. Voltage and amperage: As indicated on the Drawings.
   3. Short circuit withstand:
      a. Non-fused: 10,000A.
      b. Fused: 200,000A.

C. Accessories, when indicated in PART 3 of this Specification Section or on the Drawings:
   1. Neutral kits.
   2. Ground lug kits.
   3. Auxiliary contact kits with 1 N.O. and 1 N.C. contact.

D. Enclosures:
   1. NEMA 1 rated:
      a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
      b. With or without knockouts, hinged and lockable door.

E. Overcurrent and short circuit protective devices:
   1. Fuses.
   2. See Specification Section 16490 for overcurrent and short circuit protective device requirements.

F. Standards: NEMA KS 1, UL 98.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's instructions and recommendations.
B. Install switches adjacent to the equipment they are intended to serve unless otherwise indicated on the Drawings.
C. Permitted uses of NEMA 1 enclosure:
   1. Surface or flush mounted in electrical room.

END OF SECTION
1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. PB 1, Panelboards.
   2. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   3. Underwriters Laboratories, Inc. (UL):
      a. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
      b. 67, Standard for Panelboards.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Product technical data.
      a. Provide submittal data for all products specified in PART 2 of this Specification
      Section.
   b. See Specification Section 16010 for additional requirements.
   3. Fabrication and/or layout Drawings:
      a. Panelboard layout with alphanumeric designation, branch circuit breakers size and type,
      as indicated in the panelboard schedules.
   B. Operation and Maintenance Manuals:
      1. See Specification Section 01342 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.
      2. Panelboard schedules with as-built conditions.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Eaton.
   2. General Electric Company.
   4. Siemens.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MANUFACTURED UNITS

A. Standards: NEMA PB 1, NFPA 70, UL 50, UL 67.

B. Ratings:
   1. Current, voltage, number of phases, number of wires as indicated on the Drawings.
   2. Panelboards rated 240 Vac or less: 10,000 amp minimum short circuit rating or as indicated in the schedule.
   3. Panelboards rated 480 Vac: 14,000 amp minimum short circuit rating or as indicated in the schedule.
   4. Service Entrance Equipment rated when indicated on the Drawings.

C. Construction:
   1. Interiors factory assembled and designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
   2. Multi-section panelboards: Feed-through or sub-feed lugs.
   3. Main lugs: Solderless type approved for copper and aluminum wire.

D. Bus Bars:
   1. Main bus bars:
      a. Plated aluminum or copper sized to limit temperature rise to a maximum of 65 DegC above an ambient of 40 DegC.
      b. Drilled and tapped and arranged for sequence phasing of the branch circuit devices.
   2. Ground bus and isolated ground bus, when indicated on the Drawings: Solderless mechanical type connectors.
   3. Neutral bus bars: Insulated 100 percent rated or 200 percent rated, when indicated on the Drawings and with solderless mechanical type connectors.

E. Enclosure:
   1. Boxes: Code gage galvanized steel, furnish without knockouts.
   2. Trim assembly: Code gage steel finished with rust inhibited primer and manufacturers standard paint inside and out.
   3. Lighting and appliance panelboard:
      a. Trims supplied with hinged door over all circuit breaker handles.
      b. Trims for surface mounted panelboards, same size as box.
      c. Trims for flush mounted panelboards, overlap the box by 3/4 IN on all sides.
      d. Doors lockable with corrosion resistant chrome-plated combination lock and catch, all locks keyed alike.
      e. Nominal 20 IN wide and 5-3/4 IN deep with gutter space in accordance with NFPA 70.
      f. Clear plastic cover for directory card mounted on the inside of each door.
      g. NEMA 3R or NEMA 12 rated: Door gasketed.
   4. Power distribution panelboard:
      a. Trims cover all live parts with switching device handles accessible.
      b. Less than or equal to 12 IN deep with gutter space in accordance with NFPA 70.
      c. Clear plastic cover for directory card mounted front of enclosure.
d. NEMA 3R or NEMA 12 rated: Doors gasketed and lockable with corrosion resistant chrome-plated combination lock and catch, all locks keyed alike.

F. Overcurrent and Short Circuit Protective Devices:
   1. Main overcurrent protective device:
      a. Molded case circuit breaker.
   2. Branch overcurrent protective devices:
      a. Mounted molded case circuit breaker.
   3. See Section 16490 for overcurrent and short circuit protective device requirements.
   4. Factory installed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated on the Drawings, in accordance with the NFPA 70, and in accordance with manufacturer's instructions.

B. Support panelboard enclosures from wall studs or modular channels support structure, per Specification Section 16010.

C. Provide NEMA 1, NEMA 3R or NEMA 12 rated enclosure as indicated on the Drawings.

D. Provide each panelboard with a typed directory:
   1. Identify all circuit locations in each panelboard with the load type and location served.
   2. Mechanical equipment shall be identified by Owner-furnished designation if different than designation indicated on the Drawings.
   3. Room names and numbers shall be final building room names and numbers as identified by the Owner if different than designation indicated on the Drawings.

END OF SECTION
SECTION 16442
MOTOR CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manual motor starters.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   2. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volt Maximum).
   3. Underwriters Laboratories, Inc. (UL):
      a. 508, Standard for Industrial Control Equipment.

B. Miscellaneous:
   1. Verify motor horsepower loads, other equipment loads, and controls from approved shop
      drawings and notify Engineer of any discrepancies.
   2. Verify the required instrumentation and control wiring for a complete system and notify
      Engineer of any discrepancies.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification
      Section.
      b. See Specification Section 16010 for additional requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are
   acceptable:
   1. Eaton.
   2. General Electric Company.
   4. Siemens.

B. Submit request for substitution in accordance with Specification Section 01640.
2.2 MANUAL MOTOR STARTERS

A. Standards:
   1. NEMA 250, NEMA ICS 2.
   2. UL 508.

B. Quick-make, quick-break toggle mechanism that is lockable in the OFF position.

C. Types:
   1. Horsepower rated, for ON/OFF control.
   2. Horsepower rated, for ON/OFF control and thermal overload protection.
      a. Switch to clearly indicate ON, OFF, and TRIPPED position.

D. Voltage and current ratings and number of poles as required for the connected motor.

E. Enclosures:
   1. NEMA 4X rated:
      a. Type 304 or 316 stainless steel.
      b. No knockouts, external mounting flanges.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated on the Drawings and in accordance with manufacturer's recommendations and instructions.

B. Mounting height for surface mounted equipment: See Specification Section 16010.

END OF SECTION
SECTION 16460
DRY-TYPE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes: Dry-type transformers, 1000 kVA and less.
B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.
   4. Section 16060 - Grounding.

1.2 QUALITY ASSURANCE
A. Referenced Standards:
   1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. C57.96, Guide for Loading Dry-Type Distribution and Power Transformers.
   2. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. ST 20, Dry-Type Transformers for General Applications.
   3. Underwriters Laboratories, Inc. (UL):
      b. 1561, Standard for Safety Dry-Type General Purpose and Power Transformers.

1.3 SUBMITTALS
A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification
         Section.
      b. See Specification Section 16010 for additional requirements.
   3. Fabrication and/or layout Drawings:
      a. Nameplate Drawing.
   4. Certifications:
      a. Sound level certifications.
B. Operation and Maintenance Manuals:
   1. See Specification Section 01342 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Subject to compliance with the Contract Documents, the following manufacturers are
   acceptable:
   1. Eaton.
2. General Electric Company.
4. Siemens.
5. Sola/Hevi-Duty.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 GENERAL PURPOSE DRY-TYPE TRANSFORMERS

A. Ventilated or non-ventilated, air cooled, two (2) winding type.

B. Cores:
   1. High grade, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses.
   2. Magnetic flux densities are to be kept well below the saturation point.

C. Coils: Continuous wound with electrical grade aluminum.

D. Ventilated Units:
   1. Core and coils assembly impregnated with non-hygroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture and completely isolated from the enclosure by means of vibration dampening pads.
   2. Dripproof, NEMA 1, steel enclosure finished with a weather-resistant enamel and ventilation openings protected from falling dirt.

E. Furnish Taps for Transformers as follows:
   1. 1 PH, 2 kVA and below: None.
   2. 1 PH, 3 to 25 kVA: Two (2) 5 percent FCBN.
   3. 1 PH, 25 kVA and above: Two (2) 2.5 percent FCAN and four (4) 2.5 percent FCBN.
   4. 3 PH, 3 to 15 kVA: Two (2) 5 percent FCBN.
   5. 3 PH, 15 kVA and above: Two (2) 2.5 percent FCAN and four (4) 2.5 percent FCBN.

F. Sound Levels:
   1. Manufacturer shall guarantee not to exceed the following:
      a. Up to 9 kVA: 40 dB.
      b. 10 to 50 kVA: 45 dB.
      c. 51 to 150 kVA: 50 dB.
      d. 151 to 300 kVA: 55 dB.

G. Efficiency:
   1. Ventilated, 15 kVA and larger: Energy efficient meeting NEMA TP 1 requirements.

H. Insulating Material (600 V and below):
   1. 3 to 15 kVA units: 185 DegC insulation system with a 115 DegC rise.
   2. 15 kVA and above units: 220 DegC insulation system with a 150 DegC rise.

I. Ratings: 60 Hz, voltage, KVA and phase, as indicated on the Drawings.

J. Finish: Rust inhibited primer and manufacturers standard paint inside and out.

K. Standards: IEEE C57.96, NEMA ST 20, NEMA TP 1, UL 506, UL 1561.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Indoor Locations:
   1. Provide ventilated type for 15 kVA units and above.
   2. Provide non-ventilated type for 9 kVA units and below and were indicated on the Drawings.
3. Mount 9 kVA units and below on wall.

4. Mount 15 kVA units and above on chamfered 4 IN high concrete housekeeping pad or from wall and/or ceiling, at 7 FT above finished floor, using equipment support brackets per Section 16010.

5. Provide rubber vibrations isolation pads.

6. Enclosures: Painted steel in all areas except stainless steel in highly corrosive areas.

7. D. Ground in accordance with Section 16060.

END OF SECTION
SECTION 16490
OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Low voltage circuit breakers.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      c. C37.17, Trip Devices for AC and General Purpose DC Low Voltage Power Circuit Breakers.
   2. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   3. Underwriters Laboratories, Inc. (UL):
      b. 248-4, Low-Voltage Fuses - Part 4: Class CC Fuses.
      c. 248-8, Low-Voltage Fuses - Part 8: Class J Fuses.
      d. 248-10, Low-Voltage Fuses - Part 10: Class L Fuses.
      e. 248-12, Low-Voltage Fuses - Part 12: Class R Fuses.
      g. 943, Standard for Safety for Ground-Fault Circuit-Interrupters.
      h. 1066, Standard for Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. See Specification Section 16010 for additional requirements.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01342 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

C. Informational Submittals:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Reports:
   a. As-left condition of all circuit breakers that have adjustable settings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Circuit breakers:
      a. Eaton.
      b. General Electric Company.
      c. Square D Company.
      d. Siemens.
   2. Fuses:
      a. Eaton Bussmann, Inc.
      b. Littelfuse, Inc.
      c. Mersen

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 CIRCUIT BREAKERS

A. Molded Case Type:
   1. General:
      a. Standards: NEMA AB 1, UL 489.
      b. Unit construction.
      c. Over-center, toggle handle operated.
      d. Quick-make, quick-break, independent of toggle handle operation.
      e. Manual and automatic operation.
      f. All poles open and close simultaneously.
      g. Three (3) position handle: On, off and tripped.
      h. Molded-in ON and OFF markings on breaker cover.
      i. One-, two- or three-pole as indicated on the Drawings.
      j. Current and interrupting ratings as indicated on the Drawings.
      k. Bolt on type.
   2. Thermal magnetic type:
      a. Inverse time overload and instantaneous short circuit protection by means of a thermal magnetic element.
      b. Frame size 150 amp and below:
         1) Non-interchangeable, non-adjustable thermal magnetic trip units.
      c. Frame sizes 225 to 400 amp (trip settings less than 400A):
         1) Interchangeable and adjustable instantaneous thermal magnetic trip units.
      d. Ground Fault Circuit Interrupter (GFCI) Listed:
         1) Standard: UL 943.
         2) One- or two-pole as indicated on the Drawings.
         3) Class A ground fault circuit.
         4) Trip on 5 mA ground fault (4-6 mA range).
      e. Ground Fault Equipment Protective Circuit Interrupter (GFEPCCI) Listed:
         1) Standard: UL 1053.
         2) Trip on 30 mA ground fault (6-50 mA range).

2.3 FUSES

A. UL Class RK-5 fuses:
   2. Dual-element time-delay and current limiting rejection type.
3. Ratings: 250 and 600 V, 1/10-600 amps and 200,000 RMS AIC symmetrical.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Current and interrupting ratings as indicated on the Drawings.

B. Series rated systems not acceptable.

C. Devices shall be ambient temperature compensated.

D. Circuit Breakers:

1. Molded case circuit breakers shall incorporate the following, unless indicated otherwise on the Drawings:

   a. Frame sizes 400 amp and less with trip setting less than 400A shall be thermal magnetic type.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Type 3 SPD - Medium exposure locations (switchboard, panelboard and motor control center), integrally mounted.

B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      d. C62.45, Recommended Practice on Surge Testing For Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits.
   2. Military Standard:
   3. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. LS 1, Low Voltage Surge Protective Devices.
      a. 70, National Electrical Code (NEC).
   5. Underwriters Laboratories, Inc. (UL):
      a. 1283, Standard for Electromagnetic Interference Filters.
      b. 1449, Standard for Safety Transient Voltage Surge Suppressors.

B. Qualifications:
   1. Provide devices from a manufacturer who has been regularly engaged in the development, design, testing, listing and manufacturing of SPDs of the types and ratings required for a period of 10 years or more and whose products have been in satisfactory use in similar service.
      a. Upon request, suppliers or manufacturers shall provide a list of not less than three (3) customer references showing satisfactory operation.

1.3 DEFINITIONS

A. Clamping Voltage:
   1. The applied surge shall be induced at the 90 degree phase angle of the applied system frequency voltage.
   2. The voltage measured at the end of the 6 IN output leads of the SPD and from the zero voltage reference to the peak of the surge.
B. Let-Through Voltage:
   1. The applied surge shall be induced at the 90 degree phase angle of the applied system
      frequency voltage.
   2. The voltage measured at the end of the 6 IN output leads of the SPD and from the system
      peak voltage to the peak of the surge.

C. Maximum Continuous Operating Voltage (MCOV): The maximum steady state voltage at
   which the SPD device can operate and meet its specification within its rated temperature.

D. Maximum Surge Current:
   1. The maximum 8 x 20 microsecond surge current pulse the SPD device is capable of
      surviving on a single-impulse basis without suffering either performance degradation or
      more than 10 percent deviation of clamping voltage at a specified surge current.
   2. Listed by mode, since number and type of components in any SPD may vary by mode.

E. MCC: Motor Control Center.

F. Protection Modes: This parameter identifies the modes for which the SPD has directly
   connected protection elements, i.e., line-to-neutral (L-N), line-to-line (L-L), line-to-ground (L-
   G), neutral-to-ground (N-G).

G. Surge Current per Phase:
   1. The per phase rating is the total surge current capacity connected to a given phase
      conductor.
      a. For example, a wye system surge current per phase would equal L-N plus L-G; a delta
         system surge current per phase would equal L-L plus L-G.
      b. The N-G mode is not included in the per phase calculation.

H. System Peak Voltage: The electrical equipment supply voltage sine wave peak (i.e., for a
   480/277 V system the L-L peak voltage is 679V and the L-N peak voltage is 392 V).

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of
      the submittal process.
   2. Product technical data including:
      a. Manufacturer's qualifications.
      c. Electrical and mechanical Drawing showing unit dimensions, weights, mounting
         provisions, connection details and layout diagram of the unit.
      d. Testing procedures and testing equipment data.
      e. Create a Product Data Sheet for each different model number of SPD provided (i.e.,
         Model XYZ with disconnect and Model XYZ without disconnect, each require a
         Product Data Sheet).
   1) Data in the Product Data Sheet heading:
      a) SPD Type Number per PART 2 of the Specification.
      b) Manufacturer’s Name.
      c) Product model number.
   2) Data in the Product Data Sheet body:
      a) Column one: Specified value/feature of every paragraph of PART 2 of the
         Specification.
      b) Column two: Manufacturer’s certified value confirming the product meets the
         specified value/feature.
      c) Name of the nationally recognized testing laboratory that preformed the tests.
      d) Warranty information.
   3) Data in the Product Data Sheet closing:
      a) Signature of the manufacturer’s official (printed and signed).
      b) Title of the official.
4) Date of signature.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01342 for requirements for:
      a. The mechanics and administration of submittal process.
      b. The content of the Operation and Maintenance Manuals.
   2. Warranty.

1.5 WARRANTY

A. Minimum of a five (5) year Warranty from date of shipment against failure when installed in
   compliance with applicable national/local electrical codes and the manufacturer's installation,
   operation and maintenance instructions.

PART 2 - PRODUCTS

2.1 GENERAL

   UL 1283, UL 1449.

2.2 TYPE 3 SPD

A. Product:
   1. SPD tag number or electrical equipment tag number SPD is connected to Panel 80-LP2.
   2. Integrally mounted in panelboard.
   3. Hybrid solid state high performance suppression system.
      a. Do not use gas tubes, spark gaps or other components in suppression system which
         might short or crowbar the line resulting in interruption of normal power flow to
         connected loads.
   4. Do not connect multiple SPD modules in series to achieve the specified performance.
   5. Designed for parallel connection.
   6. Field connection: Use mechanical or compression lugs for each phase, neutral and ground
      that will accept bus bar or #10 through #1/0 conductors.
   7. Device monitor:
      a. Long-life, solid state, externally visible indicators and Form C contact(s) that monitor
         the on-line status of each mode of the units suppression filter system or power loss in
         any of the phases.
      b. A fuse status only monitor system is not acceptable.
   B. Operating Voltage: The nominal unit operating voltage and configuration as indicated on the
      Drawings.
   C. Modes of Protection:  All modes.
      1. Three phase (delta):  L-L, L-G.
      2. Three phase (wye):  L-N, L-L, L-G and N-G.
      4. Single phase:  L-N, L-G and N-G.
   D. Maximum Continuous Operating Voltage:  Less than 130 percent of system peak voltage.
   E. Operating Frequency:  45 to 65 Hz.
   F. Short Circuit Rating:  Equal to or greater than rating of equipment SPD is connected to.
   G. Maximum Surge Current:  160,000 A per phase, 80,000 A per mode minimum.
   H. Maximum Surge Current:  120,000 A per phase, 60,000 A per mode minimum.
   I. Minimum Repetitive Surge Current Capacity:  4000 IEEE C High or B combination waveform
      impulses with no degradation of more than 10 percent deviation of the clamping voltage.
J. SPD Protection:
   1. Integral unit level and/or component level overcurrent fuses and sustained overvoltage thermal cutout device.
   2. An IEEE B combination wave shall not cause the fuse to open and render the SPD inoperable.

K. Maximum Clamping Voltages: Dynamic test at the 90 degree phase angle including 6 IN lead length and measured from the zero voltage reference:

<table>
<thead>
<tr>
<th>System Voltage</th>
<th>IEEE C62.41</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Mode</td>
<td>L-L</td>
</tr>
<tr>
<td>L-L &lt; 250 V</td>
<td>1000 V</td>
</tr>
<tr>
<td>L-N &lt; 150 V</td>
<td>1000 V</td>
</tr>
<tr>
<td>L-G</td>
<td>800 V</td>
</tr>
<tr>
<td>N-G</td>
<td>800 V</td>
</tr>
<tr>
<td>L-L &gt; 250 V</td>
<td>2000 V</td>
</tr>
<tr>
<td>L-N &gt; 150 V</td>
<td>2000 V</td>
</tr>
</tbody>
</table>

L. EMI-RFI Noise Rejection: Attenuation greater than 30 dB for frequencies between 100 kHz and 100 MHz.

2.3 SOURCE QUALITY CONTROL

A. SPD approvals and ratings shall be obtained by manufacturers from nationally recognized testing laboratories.

B. The SPD are to be tested as a complete SPD system including:
   1. Integral unit level and/or component level fusing.
   2. Neutral and ground shall not be bonded during testing.
   3. 6 IN lead lengths.
   4. Integral disconnect switch when provided.

C. The “as installed” SPD system including the manufacturers recommended circuit breaker, the SPD is connected to, will not open when tested with a IEEE C3 combination waveform.

D. Tests to be performed in accordance with IEEE C62.45:
   2. Single pulse surge current capacity test.
   3. Repetitive surge current capacity testing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Type 3 SPD:
   1. Connected in parallel to the equipment.
   2. Install in dedicated electrical equipment compartment, bucket or panelboard box at the factory before shipment.
   3. Provide leads that are as short and straight as possible.
   4. Maximum lead length: 12 IN.
   5. Minimum lead size: #2 stranded AWG or bus bar.
6. Connect leads to the equipment to be protected by one (1) of the following means:
   a. Through a circuit breaker or molded case switch mounted in the equipment.
   b. Use manufacturer recommended circuit breaker size.
   c. Circuit breaker or switch to be operable from the equipment exterior or from behind a hinged door.

END OF SECTION
SECTION 16500
INTERIOR AND EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Interior building lighting fixtures.
      b. Exterior building and site lighting fixtures.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Division 03 - Concrete.
   4. Section 16010 - Electrical: Basic Requirements.
   5. Section 16120 - Wire and Cable - 600 Volt and Below.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   2. Certified Ballast Manufacturers (CBM).
   3. Federal Communications Commission (FCC):
   4. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
   5. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. LE 4, Recessed Luminaires, Ceiling Compatibility.
      a. C82.1, Lamp Ballasts - Line Frequency Fluorescent Lamp Ballast.
      b. C82.4, Ballasts for High-Intensity Discharge and Low-Pressure Sodium (LPS) Lamps (Multiple-Supply Type).
      c. C82.11, High-Frequency Fluorescent Lamp Ballasts - Supplements.
      a. 70, National Electrical Code (NEC).
   8. Underwriters Laboratories, Inc. (UL):
      a. 248-4, Low-Voltage Fuses - Part 4: Class CC Fuses.
      b. 924, Standard for Emergency Lighting and Power Equipment.
      c. 1598, Luminaires.
   8. 8750 Safety Standard for LED Lighting
   9. United States Department of Energy (USDOE):
      a. EPAct, the National Energy Policy Act.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Product technical data:
   a. Provide submittal data for all products specified in PART 2 of this Specification Section.
   b. Identify fixtures by Fixture Schedule number.
   c. Fixture data sheet including:
      1) Photometric performance data including candlepower distribution and coefficient of utilization (CU) table.
      2) Fixture effective projected areas for pole mounted fixtures.
   d. Pole data shall include:
      1) Pole wind loading.
      2) Anchor bolt template.
   e. UL nameplate data for fixtures used in Class 1, Division 1 and 2 areas.
   f. See Specification Section 16010 for additional requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Lighting fixtures: See Fixture Schedule.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 GENERAL REQUIREMENTS

A. All lighting fixtures and electrical components:
   1. UL labeled.
   2. Fixtures complete with lamps and drivers.

B. No live parts normally exposed to contact.

C. When intended for use in wet areas: Mark fixtures "Suitable for wet locations."

D. When intended for use in damp areas: Mark fixtures "Suitable for damp locations" or "Suitable for wet locations."

2.3 LIGHT FIXTURES

A. LED Fixtures:
   1. LEDs, drivers, and optics shall be manufacturer’s standard for the type fixture indicated in the Fixture Schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate fixture types with ceiling construction.
   1. Provide mounting hardware for the ceiling system in which the fixture is to be installed.

B. Provide mounting brackets and/or structural mounting support for wall-mounted fixtures.
   1. Do not support fixture from conduit system.
   2. When fixtures are supported from outlet boxes, install per NFPA 70.
   3. Supports for fixtures mounted on exterior walls shall not be attached to exterior face of the wall.

C. Mount lighting fixtures at heights indicated in Specification Section 16010 or per fixture schedule or as indicted on the Drawings.
D. Install exterior fixtures so that water can not enter or accumulate in the wiring compartment.
E. Ground fixtures and ballasts.

3.2 LIGHTING CONTROL

4. A. Exterior wall mounted fixtures shall be controlled by integral photocell.

3.3 ADJUST AND CLEAN

7. B. Replace all inoperable fixtures prior to final acceptance.

END OF SECTION
City of Watertown  
PO Box 910  
Watertown, South Dakota 57201

Attn: Craig Mitchell

Subj: Geotechnical Exploration  
Proposed Sodium Hydroxide Feed Building  
City of Watertown  
Wastewater Treatment Facility  
Watertown, South Dakota  
GeoTek #14-B80

This correspondence presents our written report of the geotechnical exploration program for the referenced project. Our work was performed in accordance with your authorization. We are transmitting an electronic copy of our report for your use. An additional copy is also being sent as noted below.

We thank you for the opportunity of providing our services on this project and look forward to continued participation during the design and construction phases. If you have any questions regarding this report, please contact our office at (605) 335-5512.

Respectfully Submitted,  
GeoTek Engineering & Testing Services, Inc.

Jared Haskins  
Jared Haskins, PE  
Geotechnical Manager  

Cc: HDR, Inc., Attn: Allan Erickson, PE, BCEE
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- Figure 1 – Test Boring Location Map
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GeoTek Engineering and Testing Services, Inc.
INTRODUCTION

Project Information

This report presents the results of the recent geotechnical exploration program for the proposed sodium hydroxide feed building for the City of Watertown in Watertown, South Dakota.

Scope of Services

Our work was performed in accordance with the authorization of Craig Mitchell with the City of Watertown. The scope of work as presented in this report is limited to the following:

1. To perform one (1) standard penetration test (SPT) boring to gather data on the subsurface conditions at the project site.

2. To perform laboratory tests that include moisture content.

3. To prepare an engineering report that includes the results of the field and laboratory tests as well as our earthwork and foundation recommendations for design and construction.

The scope of our work was intended for geotechnical purposes only. This scope of work did not include determining the presence or extent of environmental contamination at the site or to characterize the site relative to wetlands status.
FIELD DATA

Site Location & Description

The project site is located along the west edge of the Watertown Wastewater Treatment Facility in Watertown, South Dakota. The address for the facility is 1300 11th Street SE. The area designated for the proposed building is covered with vegetation.

Ground Surface Elevation & Test Boring Location

The ground surface elevation at the test boring location was determined by using the finished floor of the existing sludge thickening building (located south of the area designated for the proposed building) as a benchmark. An arbitrary elevation of 100.0 feet was used for the benchmark. Based on the benchmark datum, the ground surface elevation at the test boring location was 95.1 feet. A test boring location map, showing the relative location of the test boring, is attached at the conclusion of this report. The test boring was performed several feet outside of the footprint of the proposed building due to the presence of existing utilities.

Subsurface Conditions

One (1) test boring was performed at the project site on October 2, 2014. The subsurface conditions encountered at the test boring location are illustrated by means of the boring log included in Appendix A.

The subsurface conditions encountered at the test boring location consisted of 9 ½ feet of existing fill materials overlying coarse alluvium soils. The existing fill materials consisted of clay soils. The coarse alluvium soils consisted of sand soils. Some construction debris was encountered within the existing fill materials.

The consistency/relative density of the soils is indicated by the standard penetration resistance (“N”) values as shown on the boring logs. A description of the soil consistency/relative density based on the “N” values can be found on the attached Soil Boring Symbols and Descriptive Terminology data sheet.
We wish to point out that the subsurface conditions at other times and locations at the site may differ from those found at our test boring location. If different conditions are encountered during construction, it is important that you contact us so that our recommendations can be reviewed.

**Water Levels**

A measurement to record the groundwater level was made at the test boring location. The time and level of the groundwater reading is recorded on the boring log. Groundwater was measured at a depth of 12 feet (elevation 83.1 feet) at the test boring location.

**ENGINEERING REVIEW AND RECOMMENDATIONS**

**Project Design Data**

We understand that the project will consist of constructing a sodium hydroxide feed building for the City of Watertown in Watertown, South Dakota. The proposed building will have an approximate footprint area of 400 square feet. A tank will be located within the building. The proposed building will be supported by a mat foundation that rests near elevation 89.5 feet, which is approximately 6 feet below the existing ground surface. We anticipate light to moderate foundation loads for the proposed construction.

The information/assumptions detailed in the project design data section are important factors in our review and recommendations. If there are any corrections or additions to the information detailed in this section, it is important that you contact us so that we can review our recommendations with regards to the revised plans.

**Discussion**

The test boring encountered 9½ feet of existing fill materials overlying coarse alluvium soils. It is our opinion that the existing fill materials are not suitable for support of the proposed building. With that said, we recommend that additional site preparation be performed within the footprint of the proposed building.
Site Preparation

The site preparation for the entire footprint of the proposed building should consist of excavating through the existing fill materials in order to expose the coarse alluvium soils. We also recommend removing any existing utilities found within the footprint of the proposed building. Following the removals, we recommend placing and compacting structural fill up to the design elevations. Please refer to Table 1 for a summary of the anticipated minimum excavation depths to remove the unsuitable soils encountered at the test boring location. The depth of the excavation is expected to vary within the footprint of the proposed building.

Table 1. Estimated Excavation Depth – Footprint of the Proposed Building

<table>
<thead>
<tr>
<th>Test Boring Number</th>
<th>Ground Surface Elevation, ft</th>
<th>Anticipated Excavation Depth, ft</th>
<th>Approximate Excavation Elevation, ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>95.1</td>
<td>9 ½</td>
<td>85.6</td>
</tr>
</tbody>
</table>

If groundwater or saturated soils are encountered at the bottom of the excavation, we recommend placing a layer (6 inches to 12 inches) of drainage rock at the bottom of the excavation prior to the placement of the structural fill.

Where structural fill or drainage rock is needed below the foundation, the bottom of the excavation should be laterally oversized 1 foot beyond the edges of the foundation for each vertical foot of structural fill or drainage rock required below the foundation (1 horizontal : 1 vertical).

Foundation Loads & Settlement

If our recommendations are followed during site preparations, then it is our opinion that the foundation can be sized for a net allowable soil bearing pressure of up to 3,000 pounds per square foot (psf). We estimate total settlement of the building to be less than 1 inch and differential settlement to be around ½ inch. Unknown soil conditions at the site that are different from those depicted at the test boring location could increase the amount of expected settlement. It is our opinion that the recommended bearing pressure should provide a minimum safety factor of 3.0 against shear or base failure.
**Drainage System**

We recommend placing a minimum of 12 inches of drainage rock beneath the foundation. In addition, drainage pipes should be placed beneath the foundation with a maximum spacing of 25 feet between pipes. The drainage pipes should also be placed along the exterior of the foundation. The drainage pipes should be placed at the bottom of the drainage rock in order to collect water that accumulates in the drainage rock. The drainage pipes should be surrounded by a properly graded filter that is wrapped in a geotextile filter fabric to minimize clogging. The drainage pipes should be connected to a suitable means of discharge.

**Lateral Pressures**

The lateral earth pressure used for the design of the below-grade walls will depend on the material used to backfill the walls. A tabular listing of the equivalent fluid unit weight values is shown below.

**Table 2. Equivalent Fluid Unit Weight Values**

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>At-Rest, pcf</th>
<th>Active, pcf</th>
<th>Passive, pcf</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Drained</td>
<td>Submerged</td>
<td>Drained</td>
</tr>
<tr>
<td>Clay</td>
<td>95</td>
<td>110</td>
<td>90</td>
</tr>
<tr>
<td>Sand</td>
<td>50</td>
<td>90</td>
<td>35</td>
</tr>
</tbody>
</table>

The clay backfill can consist of lean clay soils or sandy lean clay soils. The sand backfill should consist of free-draining sand. If sand soils are selected as backfill, the zone of the sand backfill should extend a minimum of 2 feet outside the bottom of the foundation and then extend upward and outward at a slope no steeper than 1:1 (horizontal to vertical). If sand soils are used, we recommend capping the sand backfill section with 1 foot to 2 feet of clayey soil in areas that will not have asphalt concrete or concrete surfacing to minimize infiltration of surface waters.

During backfill operations, bracing and/or shoring of the walls may be needed. Only hand-operated compaction equipment should be used directly adjacent to the walls. We recommend a damp/water proofing material be applied to the walls prior to backfilling.
**Frost Protection**

We recommend that the foundation be placed at a sufficient depth for frost protection. Perimeter foundations for heated buildings should be placed such that the bottom of the foundation is a minimum of 4 feet below finished exterior grade. Interior foundations in heated buildings can be placed beneath the floor slab. Foundations for unheated areas and canopies, or foundations that are not protected from frost during freezing temperatures, should be placed at a minimum depth of 5 feet below the lowest adjacent grade.

**Material Types and Compaction Levels**

**Structural Fill** – The structural fill should consist of a pit-run or processed sand or gravel having a maximum particle size of 3 inches with less than 15 percent by weight passing the #200 sieve. The structural fill should be placed in lifts of up to 1 foot in thickness. The on-site coarse alluvium soils could be used as structural fill.

**Drainage Rock** – The drainage rock should be crushed, washed and have 100 percent by weight passing the 1-inch sieve and no more than 5 percent by weight passing the #4 sieve.

**Clay Backfill** – The clay backfill should consist of a non-organic clay having a liquid limit less than 45. Scrutiny on the clay material’s moisture content should be made prior to the acceptance and use. The clay backfill should be placed in lifts of up to 6 inches in thickness. The on-site existing fill materials should not be used as backfill due to the presence of construction debris.

**Free-Draining Sand** – The free-draining sand should contain no more than 5 percent by weight passing the #200 sieve. The free-draining sand should be placed in lifts of up to 1 foot in thickness.

**Recommended Compaction Levels** – The recommended compaction levels listed in Table 3 are based on a material’s maximum dry density value, as determined by a standard Proctor (ASTM: D698) test.
Table 3. Recommended Compaction Levels

<table>
<thead>
<tr>
<th>Placement Location</th>
<th>Compaction Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below Foundations</td>
<td>97%</td>
</tr>
<tr>
<td>Exterior Wall Backfill (Below-Grade)</td>
<td>95% - 98%</td>
</tr>
<tr>
<td>Subgrade Below Pavement Areas</td>
<td>95%</td>
</tr>
<tr>
<td>Base Course Below Pavement Areas</td>
<td>97%</td>
</tr>
<tr>
<td>Non-Structural Areas</td>
<td>90%</td>
</tr>
</tbody>
</table>

**Recommended Moisture Levels** – The moisture content of the clay backfill materials, when used as backfill around the exterior of a foundation should be maintained within a range of plus 1 percent to minus 4 percent of the materials’ optimum moisture content. When the clay backfill materials are used below a pavement area, or as site grading, the materials’ moisture content should be maintained within a range minus 1 percent to minus 4 percent of the materials’ optimum moisture content. The optimum moisture content should be determined using a standard Proctor (ASTM: D698) test.

The moisture content of the granular backfill materials should be maintained at a level that will be conducive for vibratory compaction.

**Coefficient of Friction**

A friction factor of 0.45 can be used between the drainage rock and the bottom of the concrete. The friction value is considered ultimate values. We recommend applying a theoretical safety factor of at least 2.0.

**Excavation**

The excavation within the footprint of the building should be performed with a track backhoe with a smooth edge bucket. The subgrade should not be exposed to heavy construction traffic from rubber tire vehicles.
Seismic Site Classification

It is our opinion that the soils encountered at the boring location correspond to a Site Class D (stiff soil profile) as defined in Table 1613.5.2 of the 2006 International Building Code.

Drainage

Proper drainage should be maintained during and after construction. The general site grading should direct surface run-off waters away from the excavation. Water which accumulates in the excavation should be removed in a timely manner.

Finished grades around the perimeter of the building should be sloped such that positive drainage away from the building is provided. Also, a system to collect and channel roof run-off waters away from the building is suggested.

CONSTRUCTION CONSIDERATIONS

Groundwater and Surface Water

Water may enter the excavation due to subsurface water, precipitation or surface run off. Any water that accumulates in the bottom of the excavation should be immediately removed and surface drainage away from the excavation should be provided during construction.

Cold Weather Precautions

If site preparation and construction is anticipated during cold weather, we recommend all foundations, slabs and other improvements that may be affected by frost movements be insulated from frost penetration during freezing temperatures. If filling is performed during freezing temperatures, all frozen soils, snow and ice should be removed from the areas to be filled prior to placing the new fill. The new fill should not be allowed to freeze during transit, placement and compaction. Concrete should not be placed on frozen subgrades. Frost should not be allowed to penetrate below the foundations. If floor slab subgrades freeze, we recommend the frozen soils be removed and replaced, or completely thawed, prior to placement of the floor slab. The
subgrade soils will likely require reworking and recompacting due to the loss of density caused by the freeze/thaw process.

**Excavation Sideslopes**

The excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, “Excavations and Trenches”. This document states that the excavation safety is the responsibility of the contractor. Reference to this OSHA requirement should be included in the project specifications.

**Observations and Testing**

This report was prepared using a limited amount of information for the project and a number of assumptions were necessary to help us develop our conclusions and recommendations. It is recommended that our firm be retained to review the geotechnical aspects of the final design plans and specifications to check that our recommendations have been properly incorporated into the design documents.

The recommendations submitted in this report have been made based on the subsurface conditions encountered at the test boring location. It is possible that there are subsurface conditions at the site that are different from those represented by the test boring. As a result, on-site observation during construction is considered integral to the successful implementation of the recommendations. We believe that qualified field personnel need to be on-site at the following times to observe the site conditions and effectiveness of the construction.

**Excavation**

We recommend that a geotechnical engineer or geotechnical engineering technician working under the direct supervision of a geotechnical engineer observe all excavations for foundations, slabs and pavements. These observations are recommended to determine if the exposed soils are similar to those encountered at the test boring location, if unsuitable soils have been adequately removed and if the exposed soils are suitable for support of the proposed construction. These observations should be performed prior to placement of fill or foundations.
Testing

After the subgrade is observed by a geotechnical engineer/technician and approved, we recommend a representative number of compaction tests be taken during the placement of the structural fill and backfill placed below foundations, slabs and pavements, beside foundation walls and behind retaining walls. The tests should be performed to determine if the required compaction has been achieved. As a general guideline, we recommend at least one (1) test be taken for every 2,000 square feet of structural fill placed in building and paved areas, at least one (1) test for every 75 feet to 100 feet in trench fill, and for every 2-foot thickness of fill or backfill placed. The actual number of tests should be left to the discretion of the geotechnical engineer. Samples of proposed fill and backfill materials should be submitted to our laboratory for testing to determine their compliance with our recommendations and project specifications.

SUBSURFACE EXPLORATION PROCEDURES

Test Borings

We drilled one (1) SPT boring on October 2, 2014 with a truck rig equipped with hollow-stem auger. Soil sampling was performed in accordance with the procedures described in ASTM:D1586. Using this procedure, a 2-inch O.D. split barrel sampler is driven into the soil by a 140-pound weight falling 30 inches. After an initial set of 6 inches, the number of blows required to drive the sampler an additional 12 inches is known as the penetration resistance, or “N” value. The “N” value is an index of the relative density of cohesionless soils and the consistency of cohesive soils. In addition, thin walled tube samples were obtained according to ASTM:D1587, where indicated by the appropriate symbol on the boring log.

The test boring was backfilled with on-site materials and some settlement of these materials can be expected to occur. Final closure of the hole is the responsibility of the client or property owner.

The soil samples collected from the test boring location will be retained in our office for a period of one (1) month after the date of this report and will then be discarded unless we are notified otherwise.
Soil Classification

As the samples were obtained in the field, they were visually and manually classified by the crew chief according to ASTM:D2488. Representative portions of all samples were then sealed and returned to the laboratory for further examination and for verification of the field classification. In addition, select samples were then submitted to a program of laboratory tests. Where laboratory classification tests (sieve analysis and Atterberg limits) have been performed, classifications according to ASTM:D2487 are possible. The log of the test boring indicating the depth and identification of the various strata, the “N” value, the laboratory test data, water level information and pertinent information regarding the method of maintaining and advancing the drill hole are also attached in Appendix A. Charts illustrating the soil classification procedures, the descriptive terminology and the symbols used on the boring log are also attached in Appendix A.

Water Level Measurements

The water level indicated on the boring log may or may not be an accurate indication of the depth or lack of subsurface groundwater. The limited length of observation restricts the accuracy of the measurements. Long term groundwater monitoring was not included in our scope of work.

Subsurface groundwater levels should be expected to fluctuate seasonally and yearly from the groundwater readings recorded at the test boring. Fluctuations occur due to varying seasonal and yearly rainfall amounts and snowmelt, as well as other factors. It is possible that the subsurface groundwater levels during or after construction could be significantly different than the time the test boring was performed.

Laboratory Tests

Laboratory tests were performed on select samples to aid in determining the index properties of the soils. The index tests consisted of moisture content. The laboratory tests were performed in accordance with the appropriate ASTM procedures. The results of the laboratory tests are shown on the boring log opposite the samples upon which the tests were performed.
LIMITATIONS

The recommendations and professional opinions submitted in this report were based upon the data obtained through the sampling and testing program at the test boring location. We wish to point out that because no exploration program can totally reveal the exact subsurface conditions for the entire site, conditions between samples and at other times may differ from those described in our report. Our exploration program identified subsurface conditions only at those points where samples were retrieved or where water was observed. It is not standard engineering practice to continuously retrieve samples for the full depth of the test boring. Therefore, strata boundaries and thicknesses must be inferred to some extent. Additionally, some soils layers present in the ground may not be observed between sampling intervals. If the subsurface conditions encountered at the time of construction differ from those represented by our test boring, it is important to contact us so that our recommendations can be reviewed. The variations may result in altering our conclusions or recommendations regarding site preparation or construction procedures, thus, potentially affecting construction costs.

This report is for the exclusive use of the addressee and its representatives for use in design of the proposed project described herein and preparation of construction documents. Without written approval, we assume no responsibility to other parties regarding this report. Our conclusions, opinions and recommendations may not be appropriate for other parties or projects.

STANDARD OF CARE

The recommendations submitted in this report represent our professional opinions. Our services for your project were performed in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering profession currently practicing at this time and area.

This report was prepared by:
GeoTek Engineering & Testing Services, Inc.

Jared Haskins, PE
Geotechnical Manager

GeoTek Engineering and Testing Services, Inc.
**Project:** Proposed Sodium Hydroxide Feed Building, City of Watertown, Wastewater Treatment Facility, Watertown, SD

### Geotechnical Test Boring Log

<table>
<thead>
<tr>
<th>Depth in Feet</th>
<th>Description of Material</th>
<th>Geologic Origin</th>
<th>N</th>
<th>Sample WL</th>
<th>Sample No.</th>
<th>Sample Type</th>
<th>WC</th>
<th>D</th>
<th>LL</th>
<th>PL</th>
<th>QU</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Fill, Mostly Clay: black, moist, a little construction debris</td>
<td>Fill</td>
<td>5</td>
<td>4</td>
<td>SPT</td>
<td>34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9½</td>
<td>Fill, Mostly Clay: a little gravel, dark brown, moist, a little construction debris</td>
<td>Fill</td>
<td>13</td>
<td>2</td>
<td>SPT</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Sand: a trace of gravel, fine to medium grained, gray, dry, dense, (SP)</td>
<td>Coarse Alluvium</td>
<td>18</td>
<td>6</td>
<td>SPT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Sand: a little gravel, medium grained, gray, wet to waterbearing, medium dense to dense, (SP)</td>
<td>Coarse Alluvium</td>
<td>9</td>
<td>8</td>
<td>SPT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bottom of borehole at 21 feet.

### Laboratory Tests

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Sampled Depth</th>
<th>Casing Depth</th>
<th>Cave-In Depth</th>
<th>Water Level</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-2-14</td>
<td>9:15 am</td>
<td>21</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>3.25&quot; ID Hollow Stem Auger</td>
</tr>
</tbody>
</table>

**WATER LEVEL MEASUREMENTS**

**Start:** 10-2-14 **Complete:** 10-2-14 9:15 am

**Method:** 3.25" ID Hollow Stem Auger

**Crew Chief:** Roy Hanson
## Soil Classification Chart

<table>
<thead>
<tr>
<th>Major Divisions</th>
<th>Symbols</th>
<th>Typical Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coarse Grained Soils</strong></td>
<td><strong>GW</strong></td>
<td>Well-graded gravels, gravel - sand mixtures, little or no fines</td>
</tr>
<tr>
<td><strong>Gravel and Gravelly Soils</strong></td>
<td><strong>GP</strong></td>
<td>Poorly-graded gravels, gravel - sand mixtures, little or no fines</td>
</tr>
<tr>
<td><strong>Sand and Sandy Soils</strong></td>
<td><strong>GM</strong></td>
<td>Silty gravels, gravel - sand - silt mixtures</td>
</tr>
<tr>
<td><strong>Clean Gravels</strong></td>
<td><strong>GC</strong></td>
<td>Clayey gravels, gravel - sand - clay mixtures</td>
</tr>
<tr>
<td><strong>Gravels with Fines</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Clean Sands</strong></td>
<td><strong>SW</strong></td>
<td>Well-graded sands, gravelly sands, little or no fines</td>
</tr>
<tr>
<td><strong>Sands with Fines</strong></td>
<td><strong>SP</strong></td>
<td>Poorly-graded sands, gravelly sand, little or no fines</td>
</tr>
<tr>
<td><strong>Sand and Sandy Soils</strong></td>
<td><strong>SM</strong></td>
<td>Silty sands, sand - silt mixtures</td>
</tr>
<tr>
<td><strong>Clayey Sands, Sand - Clay Mixtures</strong></td>
<td><strong>SC</strong></td>
<td>Clayey sands, sand - clay mixtures</td>
</tr>
<tr>
<td><strong>Silty Sands, Sand - Silty Mixtures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sandy Soils</strong></td>
<td><strong>ML</strong></td>
<td>Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity</td>
</tr>
<tr>
<td><strong>Silt and Clays</strong></td>
<td><strong>CL</strong></td>
<td>Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays</td>
</tr>
<tr>
<td><strong>Clayey Soils</strong></td>
<td><strong>OL</strong></td>
<td>Organic silts and organic silty clays of low plasticity</td>
</tr>
<tr>
<td><strong>Silty Soils</strong></td>
<td><strong>MH</strong></td>
<td>Inorganic silts, micaceous or diatomaceous fine sand or silty soils</td>
</tr>
<tr>
<td><strong>Clay Soils</strong></td>
<td><strong>CH</strong></td>
<td>Inorganic clays of high plasticity</td>
</tr>
<tr>
<td><strong>Clayey Soils</strong></td>
<td><strong>OH</strong></td>
<td>Organic clays of medium to high plasticity, organic silts</td>
</tr>
<tr>
<td><strong>Highly Organic Soils</strong></td>
<td><strong>PT</strong></td>
<td>Peat, humus, swamp soils with high organic contents</td>
</tr>
</tbody>
</table>

*Note: Dual symbols are used to indicate borderline soil classifications.*
BORING LOG SYMBOLS AND DESCRIPTIVE TERMINOLOGY

SYMBOLS FOR DRILLING AND SAMPLING

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bag</td>
<td>Bag sample</td>
</tr>
<tr>
<td>CS</td>
<td>Continuous split-spoon sampling</td>
</tr>
<tr>
<td>DM</td>
<td>Drilling mud</td>
</tr>
<tr>
<td>FA</td>
<td>Flight auger; number indicates outside diameter in inches</td>
</tr>
<tr>
<td>HA</td>
<td>Hand auger; number indicates outside diameter in inches</td>
</tr>
<tr>
<td>HSA</td>
<td>Hollow stem auger; number indicates inside diameter in inches</td>
</tr>
<tr>
<td>LS</td>
<td>Liner sample; number indicates outside diameter of liner sample</td>
</tr>
<tr>
<td>N</td>
<td>Standard penetration resistance (N-value) in blows per foot</td>
</tr>
<tr>
<td>NMR</td>
<td>No water level measurement recorded, primarily due to presence of drilling fluid</td>
</tr>
<tr>
<td>NSR</td>
<td>No sample retrieved; classification is based on action of drilling equipment and/or material noted in drilling fluid or on sampling bit</td>
</tr>
<tr>
<td>SH</td>
<td>Shelby tube sample; 3-inch outside diameter</td>
</tr>
<tr>
<td>SPT</td>
<td>Standard penetration test (N-value) using standard split-spoon sampler</td>
</tr>
<tr>
<td>SS</td>
<td>Split-spoon sample; 2-inch outside diameter unless otherwise noted</td>
</tr>
<tr>
<td>WL</td>
<td>Water level directly measured in boring</td>
</tr>
</tbody>
</table>

SYMBOLS FOR LABORATORY TESTS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>WC</td>
<td>Water content, percent of dry weight; ASTM:D2216</td>
</tr>
<tr>
<td>D</td>
<td>Dry density, pounds per cubic foot</td>
</tr>
<tr>
<td>LL</td>
<td>Liquid limit; ASTM:D4318</td>
</tr>
<tr>
<td>PL</td>
<td>Plastic limit; ASTM:D4318</td>
</tr>
<tr>
<td>QU</td>
<td>Unconfined compressive strength, pounds per square foot; ASTM:D2166</td>
</tr>
</tbody>
</table>

DENSITY/CONSISTENCY TERMINOLOGY

<table>
<thead>
<tr>
<th>Density Term</th>
<th>N-Value</th>
<th>Consistency Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Loose</td>
<td>0-4</td>
<td>Soft</td>
</tr>
<tr>
<td>Loose</td>
<td>5-8</td>
<td>Firm</td>
</tr>
<tr>
<td>Medium Dense</td>
<td>9-15</td>
<td>Stiff</td>
</tr>
<tr>
<td>Dense</td>
<td>16-30</td>
<td>Very Stiff</td>
</tr>
<tr>
<td>Very Dense</td>
<td>Over 30</td>
<td>Hard</td>
</tr>
</tbody>
</table>

PARTICLE SIZES

<table>
<thead>
<tr>
<th>Term</th>
<th>Particle Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boulder</td>
<td>Over 12&quot;</td>
</tr>
<tr>
<td>Cobble</td>
<td>3” – 12”</td>
</tr>
<tr>
<td>Gravel</td>
<td>#4 – 3”</td>
</tr>
<tr>
<td>Coarse Sand</td>
<td>#10 – #4</td>
</tr>
<tr>
<td>Medium Sand</td>
<td>#40 – #10</td>
</tr>
<tr>
<td>Fine Sand</td>
<td>#200 – #40</td>
</tr>
<tr>
<td>Silt and Clay</td>
<td>passes #200 sieve</td>
</tr>
</tbody>
</table>

DESCRIPTIVE TERMINOLOGY

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Absence of moisture, powdery</td>
</tr>
<tr>
<td>Frozen</td>
<td>Frozen soil</td>
</tr>
<tr>
<td>Moist</td>
<td>Damp, below saturation</td>
</tr>
<tr>
<td>Waterbearing</td>
<td>Pervious soil below water</td>
</tr>
<tr>
<td>Wet</td>
<td>Saturated, above liquid limit</td>
</tr>
<tr>
<td>Lamination</td>
<td>Up to ½&quot; thick stratum</td>
</tr>
<tr>
<td>Layer</td>
<td>½” to 6” thick stratum</td>
</tr>
<tr>
<td>Lens</td>
<td>½” to 6” discontinuous stratum</td>
</tr>
</tbody>
</table>

GRAVEL PERCENTAGES

<table>
<thead>
<tr>
<th>Term</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A trace of gravel</td>
<td>2-4%</td>
</tr>
<tr>
<td>A little gravel</td>
<td>5-15%</td>
</tr>
<tr>
<td>With gravel</td>
<td>16-50%</td>
</tr>
</tbody>
</table>
To: City of Watertown, Attn: Craig Mitchell  
From: Jared Haskins, PE  
Subject: Proposed Sodium Hydroxide Feed Building  
City of Watertown  
Wastewater Treatment Facility  
Watertown, South Dakota  
GeoTek #14-B80  
Date: 11/14/14  
Cc: HDR, Inc., Attn: Michael Johnson

This correspondence summarizes our phone conversation with Michael Johnson with HDR, Inc. regarding the drainage system for the referenced project.

In our geotechnical exploration report that was dated October 8, 2014, we recommended installing a drainage system beneath the new building. The drainage system consists of a minimum of 12 inches of drainage rock and drainage pipes within the drainage rock. The purpose of the drainage system is to collect and remove water that may accumulate beneath the building. The drainage system will not provide any structural benefit to the building.

We understand that the building will have a sump. In addition, water stops will be installed. In our opinion, the sump and water stops will provide sufficient water control.

We trust this correspondence provides you with the needed information. If there are any questions or comments, please contact our office.