SPECIFICATIONS

FOR

NORTHERN KENTUCKY WATER DISTRICT

Dudley Complex
Sodium Hypochlorite Building

May, 2015

CONFORMANCE SET

COMPILED BY:
NORTHERN KENTUCKY WATER DISTRICT
2835 Crescent Springs Road
P.O. Box 18640
Erlanger, Kentucky 41018

IN ASSOCIATION WITH:

S P E C I F I C A T I O N S

FOR

NORTHERN KENTUCKY WATER DISTRICT

Dudley Complex Sodium Hypochlorite Building

May, 2015

GOVERNING BODY

COMMISSIONERS:

DR. PATRICIA SOMMERKAMP – CHAIR
DAVID M. SPAULDING ESQ.. - VICE-CHAIR
FRED A. MACKE, JR. - SECRETARY
CLYDE CUNNINGHAM - TREASURER
ANDREW C. COLLINS - COMMISSIONER
DOUGLAS C. WAGNER - COMMISSIONER

RON LOVAN, PRESIDENT/CEO

COMPILED BY:
Northern Kentucky Water District
2835 Crescent Springs Road
P.O. Box 18640
Erlanger, Kentucky 41018

IN ASSOCIATION WITH:

801 Corporate Drive
Lexington, KY 40503

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DIVISION 00

PROCUREMENT AND CONTRACTING REQUIREMENTS - NONFUNDED

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Section 001120

INVITATION TO BID

Advertisement Run Dates: April 2, 2015 and April 16, 2015

PROJECT**:** Dudley Complex Sodium Hypochlorite Building

SEALED BIDS WILL BE RECEIVED AT:

Northern Kentucky Water District (Owner)
2835 Crescent Springs Road
P.O. Box 18640
Erlanger, Kentucky 41018

UNTIL: Date: April 30, 2015
Time: 1:00 p.m., local time

At said place and time, and promptly thereafter, all Bids that have been duly received will be publicly opened and read aloud.

The proposed Work is generally described as follows: Construction of improvements to demolish the existing building at the Dudley complex and constructing a new building to house the sodium hypochlorite equipment. The project will also include new buried chemical feed piping and electrical connections to the existing pumping station.

All Bids must be in accordance with the Instructions to Bidders and Contract Documents on file, and available for examination at: Northern Kentucky Water District, 2835 Crescent Springs Road, Erlanger, Kentucky, 41018; or GRW Engineers, 801 Corporate Drive, Lexington, Kentucky, 40503.

Copies of the Bidding Documents may be obtained from GRW Engineers at the address indicated herein. Charges for all documents obtained will be made on the following basis:

	Charge
Complete set of Bidding Documents	$ 200.00
Mailing and Handling	$ 15.00

Charges for Bidding Documents and mailing and handling, if applicable, will not be refunded. The $15.00 above is for standard U.S. Postal Service shipping. If a request is made that the bid documents be shipped via FedEx, the purchaser must provide the Engineer's office with their account number so that they are billed directly from FedEx.

Prospective Bidders may address written inquiries to Alan Bryan with GRW Engineers (abryan@grwinc.com).

Bids will be received on a lump sum basis as described in the Contract Documents.

Bid security, in the form of a certified check or Bid Bond (insuring/bonding company shall be rated "A" by AM Best) in the amount of ten percent (10%) of the maximum total bid price, must accompany each Bid.

The Successful Bidder will be required to furnish a Construction Performance Bond and a Construction Payment Bond (insuring/bonding company shall be rated “A” by AM Best) as security for the faithful performance of the project and the payment of all bills and obligations arising from the performance of the Contract.

The Successful Bidder and all Subcontractors will be required to conform to the labor standards set forth in the Contract Documents. This project falls under the provisions of KRS 337.505 to 337.550 for prevailing wage rates.

The evaluation of Bids will be subject to the reciprocal preference for Kentucky resident bidders pursuant to KRS 45A.490 to 45A.494 and KAR 200 5:400.

Owner reserves the right to reject any or all Bids, including without limitation the right to reject any or all nonconforming, non-responsive, incomplete, unbalanced, or conditional Bids, to waive informalities, and to reject the Bid of any Bidder if Owner believes that it would not be in the best interest of Owner to make an award to that Bidder. Owner also reserves the right to negotiate with the apparent Successful Bidder to such an extent as may be determined by Owner.

A non-mandatory prebid conference will be held for prospective Bidders on April 21, 2015 at 10:30 a.m. at the Dudley site. The address is given in the Instructions to Bidders.

On request 72 hours in advance, Owner will provide each Bidder access to the site to conduct such investigations and tests as each Bidder deems necessary for submission of a Bid. Arrangements for site visits shall be made by calling Dave Enzweiler, Maintenance Supervisor with the Northern Kentucky Water District, at (859) 547-3265.

Minority Bidders are encouraged to bid.

Bids shall remain subject to acceptance for 90 days after the day of bid opening or for such longer period of time to which a Bidder may agree in writing upon request of the Owner. If a Contract is to be awarded, the Owner will give the Successful Bidder a Notice of Award during the period of time during which the Successful Bidder’s bid remains subject to acceptance.

Amy Kramer, Acting V.P. Engineering, Production & Distribution
Northern Kentucky Water District

End of Section

Section 002100

INSTRUCTIONS TO BIDDERS

1. DEFINED TERMS. Terms used in these Instructions to Bidders will have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below which are applicable to both the singular and plural thereof:

A. *Bidder* - The individual or entity who submits a Bid directly to Owner.

B. *Successful Bidder* - The lowest responsible Bidder submitting a responsive Bid to whom Owner (on the basis of Owner's evaluation as hereinafter provided) makes an award.

2. COPIES OF CONTRACT DOCUMENTS. Complete sets of Contract Documents must be used in preparing Bids; Bidder shall have sole responsibility for errors or misrepresentations resulting from the use of incomplete sets of Bidding Documents.

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

3. QUALIFICATIONS OF BIDDERS. To demonstrate Bidder's qualifications to perform the Work, within five days of Owner's request Bidder shall submit written evidence such as financial data, previous experience, present commitments, and such other data as may be requested by Owner. Bidders who have not, in the Owner's opinion, had sufficient experience in the size and type of work involved may not be considered.

Each Bid must contain evidence of Bidder's qualifications to transact business in the State of Kentucky or covenant to obtain such qualifications prior to award of the Contract. The Bidder's Organization Number from the Kentucky's Secretary of State and principal place of business as filed with Kentucky's Secretary of State must be included where applicable.

Each Bidder must be registered as a plan holder with the Issuing Office or Engineer on record in the advertised "Invitation to Bid". There shall be no substitution of bidders without proper registration with the Issuing Office or Engineer on record in the advertised "Invitation to Bid"

4. EXAMINATION OF CONTRACT DOCUMENTS AND SITE. It is the responsibility of each Bidder, before submitting a Bid, to:

a. thoroughly examine and study the Instructions to Bidders and the Contract Documents, including any Addenda;

b. visit the Site and become familiar with and satisfy Bidder as to the general, local, and site conditions that may affect cost, progress, performance, or furnishing of the Work;

c. become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, performance, or furnishing of the Work;

d. agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times and in accordance with the other terms and conditions of the Contract Documents;

e. correlate the information known to Bidder, information and observations obtained from visits to the Site, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents;

f. promptly give Owner written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Contract Documents and confirm that the written resolution thereof by Owner is acceptable to Bidder; and

g. determine that the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.

4.01. Underground Facilities. Information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner or others, and Owner and Engineer disclaim responsibility for the accuracy or completeness thereof, unless it is expressly provided otherwise in the Supplementary Conditions.

4.02. Additional Information. Before submitting a Bid, each Bidder may, at Bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests, and studies and obtain any additional information and data which pertain to subsurface or physical conditions at or contiguous to the Site or otherwise, which may affect cost, progress, performance, or furnishing of the Work and which Bidder deems necessary to determine its Bid for performing and furnishing the Work in accordance with the time, price, and other terms and conditions of the Contract Documents. Each Bidder shall be responsible for any claims for personal injury, death or damage to property caused by Bidder's entry on public or private property and shall defend and indemnify Owner and all other parties against any such claims.

4.03. Bidder's Representation. The submission of a Bid will constitute an incontrovertible representation and covenant by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Contract Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Contract Documents, that Bidder has given Owner written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Contract Documents and the written resolutions thereof are acceptable to Bidder, and that the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

5. PREBID CONFERENCE. A non-mandatory prebid conference will be held for prospective Bidders on April 21, 2015 at 10:30 a.m. at the Dudley site which is located at 846 Dudley Road in Edgewood, Kentucky. The site is accessed using Rodgers Road, which is located at the intersection with Winding Trails Road and Dudley Road. Representatives of the Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. The site is secured and access at other times will require

prospective Bidders to contact the District. Arrangements for site visits shall be made by calling Dave Enzweiler, Maintenance Supervisor with the Northern Kentucky Water District, at (859) 547-3265, 72 hours in advance. The Engineer will transmit to prospective Bidders of record such Addenda as the Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

6. SITE AND OTHER AREAS. The Site is identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Contract Documents.

7. INTERPRETATIONS AND ADDENDA. All questions about the meaning or intent of the Bidding Documents are to be submitted to Owner in writing. Any interpretations or clarifications that are considered necessary by Owner in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Owner as having received the Bidding Documents. Questions received less than 72 hours prior to the date for opening of Bids may not be answered. The person submitting questions shall be responsible for their prompt delivery. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or Engineer.

Owner will not be responsible for explanations or interpretations of the Bidding Documents or Contract Documents except as issued in accordance herewith.

8. BID SECURITY. Each Bid must be accompanied by Bid security made payable to Owner in an amount of 10 percent of Bidder's maximum Bid price and in the form of a certified check or Bid Bond (see Specification Section 004313-Bid Bond) issued by a surety meeting the requirements of paragraphs 5.01 and 5.02 of the General Conditions and shall be rated “A” by AM BEST.

Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may annul the Notice of Award and Bid security of that Bidder will be forfeited. Bid security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Agreement or one day after the last day the Bids remain subject to acceptance, whereupon Bid security furnished by such Bidders will be returned.

9. CONTRACT TIMES. The numbers of days within which, or the dates by which, the Work is to be (a) Substantially Completed and (b) also completed and ready for final payment are set forth in the Agreement.

10. LIQUIDATED DAMAGES. Provisions for liquidated damages are set forth in the Agreement.

11. SUBSTITUTE OR "OR-EQUAL" ITEMS. The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or "or-equal" items. Whenever it is specified or described in the Bidding Documents that a substitute or "or-equal" item of material or equipment may be furnished or used by Contractor if acceptable to Owner, application for such acceptance will not be considered by Owner until after the Effective Date of the Agreement. The procedure for submission of any such application by Contractor and consideration by Owner is set forth in the General Conditions and may be supplemented in the General Requirements.

12. PREPARATION OF BID. The Bid form is included with the Bidding Documents. Additional copies may be obtained from Owner.

All blanks on the Bid form shall be completed by printing in ink or by typewriter and the Bid signed. A Bid price shall be indicated for each lump sum bid item and/or unit price item listed therein, or the words "No Bid", "No Change", or "Not Applicable" entered.

A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature.

A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown below the signature.

A Bid by a limited liability company shall be executed in the name of the firm by a member (if member-managed) or manager (if manager-managed) and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown below the signature.

A Bid by an individual shall show the Bidder's name and official address.

A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid form. The official address of the joint venture must be shown below the signature.

All names shall be typed or printed in ink below the signatures.

The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid form.

The address and telephone number for communications regarding the Bid shall be shown.

The Bid shall identify whether the Bidder is a resident or nonresident bidder for purposes of Kentucky's reciprocal preference statute (KRS 45A.490 to 45A.494 and 200 KAR 5:400). If the Bidder is claiming a "resident bidder" status as defined in KRS 45A.494(2), the Bid shall include a properly executed and notarized affidavit affirming that it meets the criteria to be considered such a resident bidder. If requested by Owner, Bidder shall also provide

documentation proving such resident bidder status; failure to do so shall result in disqualification of the Bidder or contract termination.

While the Bidder should consult the applicable statutes and regulation, generally speaking, a “resident bidder” is an individual or business entity that, on the date the contract is first advertised or announced as available for bidding: (a) is authorized to transact business in the Commonwealth; AND (b) has for one (1) year prior to and through the date of the advertisement, (i) filed Kentucky corporate income taxes, (ii) made payments to the Kentucky unemployment insurance fund established in KRS 341.490, and (iii) maintained a Kentucky workers' compensation policy in effect. A “nonresident bidder” is any other individual or business entity.

13. BASIS OF BID. Bidders shall submit a Bid on a lump sum basis. Discrepancies between words and figures will be resolved in favor of the words.

14. SUBMITTAL OF BID. A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the advertisement or invitation to Bid and shall be enclosed in an opaque sealed envelope plainly marked with the Project title, the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate envelope plainly marked on the outside with the notation "Bid Enclosed".

Bids shall be addressed to Owner at:

Northern Kentucky Water District (Owner)
2835 Crescent Springs Road
P.O. Box 18640
Erlanger, Kentucky 41018

One complete and executed Bid Form along with “Non-Collusion Affidavit”, “Resident Bidder Status Affidavit”, “Bidders Qualifications Questionnaire”, Supplements to Bid Form, if applicable, and Bid Bond shall be submitted. Bids shall be typed or in ink. Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids. Bids received after the time and date for receipt of Bids may be returned unopened. Oral, telephone, facsimile, or telegraph Bids are invalid and will not receive consideration.

15. MODIFICATION AND WITHDRAWAL OF BIDS. A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. For a period ending 72 hours after Bids are opened, any Bidder may request the withdrawal of its Bid by filing with Owner a duly signed written notice and otherwise demonstrating by clear and convincing evidence to the reasonable satisfaction of Owner that the Bid was submitted in good faith but there was a material and/or substantial mistake in the preparation of its Bid. If the withdrawal of the Bid is approved by the Owner in its sole discretion, the Bid security will be returned. Without the advanced full disclosure by the withdrawing Bidder to and written consent of the Owner, (a) no Bid shall be withdrawn under this section when the result would be the awarding of the contract on another Bid of the same Bidder or of another Bidder in which the withdrawing Bidder has a direct or indirect equitable interest and (b) no Bidder who is permitted to withdraw a Bid shall, for compensation, supply any material or labor to or perform any subcontract or other work agreement for the Bidder to

whom the contract is awarded or otherwise benefit, directly or indirectly, from the performance of the Project.

16. OPENING OF BIDS. Bids will be opened at the time and place indicated in the advertisement or Invitation to Bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

17. BIDS TO REMAIN SUBJECT TO ACCEPTANCE. All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

18. AWARD OF CONTRACT. Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, non-responsive, incomplete, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder which it finds, after reasonable inquiry and evaluation, to be non-responsive. Owner may also reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Owner to make an award to that Bidder. Owner also reserves the right to waive all informalities and to negotiate with the apparent Successful Bidder to such an extent as may be determined by Owner. The Owner also reserves the right to increase or decrease the quantities of work per the General Conditions.

In evaluating Bids, Owner will consider, among other lawful considerations, the following:

a. Whether or not the Bid complies with the prescribed requirements, and provides such alternates, unit prices and other information or data as may be requested in the Bid Form or prior to the Notice of Award.

b. The qualifications of the Bidder.

c. If the Bidder maintains a permanent place of business.

d. If the Bidder has adequate personnel, plant and equipment to perform the Work properly and expeditiously.

e. Bidder's financial status to meet all obligations and incidentals to the Work.

f. Whether the Bidder has appropriate technical expertise and experience.

g. Bidder's performance record.

h. The amount of the TOTAL BASE BID, exclusive of any additive alternates, if applicable. Any additive alternates will be considered after selection of the lowest Total Base Bid. Each additive alternate will be considered and selected or not selected individually, at Owner's discretion, for inclusion in the work.

In addition, the evaluation of Bids will be subject to the reciprocal preference for Kentucky resident bidders pursuant to KRS 45A.490 to 45A.494 and KAR 200 5:400. These statutes and regulation provide in part as follows: (a) a resident bidder of the Commonwealth shall be given a preference against a nonresident bidder registered in any state that gives or requires a preference to bidders from that state; (b) the preference shall be equal to the preference given or required by the state of the nonresident bidder; (c) this preference shall not be applied against nonresident bidders residing in states that do not give preference against

Kentucky bidders; (d) if a procurement determination results in a tie between a resident bidder and a nonresident bidder, preference shall be given to the resident bidder; and (e) the preference shall not result in a nonresident bidder receiving a preference over another nonresident bidder.

Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders to perform the Work in accordance with the Contract Documents, including, without limitation, a Bidder's claim that it is a resident bidder for purposes of Kentucky's preference statute.

19. CONTRACT SECURITY AND INSURANCE. Article 5 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment Bonds and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by such Bonds.

20. SIGNING OF AGREEMENT. When Owner gives a Notice of Award to the Successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents identified in the Agreement as attached thereto. Within 15 days thereafter, the Successful Bidder shall sign, leaving the dates blank, and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within 15 days thereafter, Owner shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

21. RETAINAGE. Provisions concerning retainage are set forth on the Agreement.

End of Section

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GEOTECHNICAL EXPLORATION REPORT

PART 1 - GENERAL

1.1 Geotechnical Exploration Report

A. The report of geotechnical data titled "Geotechnical Exploration Report, Sodium Hypochlorite Building, NKWD Dudley Complex" as investigated and written by Thelen Associates, Inc., has been included in this specification document as Appendix "A". The geotechnical report shall be used as a reference for the execution of this work and all recommendations included therein shall be followed in full.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 003132

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Section 004100

BID FORM

PROJECT IDENTIFICATION: **Dudley Complex Sodium Hypochlorite Building**

THIS BID IS SUBMITTED TO:

Northern Kentucky Water District (Owner)
P.O. Box 18640
2835 Crescent Springs Road
Erlanger, Kentucky 41018

THIS BID IS SUBMITTED BY: _____
(Bidder's Company Name)

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

2. Bidder accepts all of the terms and conditions of the Invitation to Bid and the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time to which the Bidder may agree in writing upon request of Owner. Bidder understands that certain extensions to the time for acceptance of this Bid may require the consent of the surety for the Bid Bond.

3. In submitting this Bid, Bidder represents and covenants, as set forth in the Agreement, that:
   a. Bidder has examined and carefully studied the Contract Documents, the other related data identified in the Contract Documents, and the following Addenda, receipt of all of which is hereby acknowledged:

      No. _____ Dated _____

      No. _____ Dated _____

      No. _____ Dated _____

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

   c. Bidder is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.

   d. Bidder has obtained and carefully studied (or assumes responsibility for having done so) all additional or supplementary explorations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods,

techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto.

e. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.

f. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

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

h. Bidder has given Owner written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Owner is acceptable to Bidder.

i. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.

j. [Check the one that applies]

_____ Bidder is a “resident bidder” as defined in KRS 45A.494(2) of Kentucky’s resident bidder reciprocal preference statute AND submits with this Bid a properly executed and notarized Affidavit that affirms that Bidder meets the resident bidder criteria, which Affidavit is hereby incorporated herein and made a part of this Bid.

OR

_____ Bidder is a “nonresident bidder” as defined in KRS 45A.494(3) of Kentucky’s resident bidder reciprocal preference statute AND its principal place of business as identified its Certificate of Authority to transact business in Kentucky as filed with Kentucky’s Secretary of State or, if Bidder hereby represents and covenants that it is not required to obtain a Certificate of Authority to transact business in Kentucky, its mailing address, is:

_____

_____

_____

k. Bidder's Organization Number from Kentucky's Secretary of State is #_____ [if applicable] and Bidder is qualified to transact business in the State of Kentucky or hereby covenants to obtain such qualifications prior to award of the Contract.

4. Bidder further represents that 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 agreement or rules of any group, association, organization, or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any individual or entity to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

5. The Bidder understands and agrees that during the performance of the Contract, it shall maintain a presence within such proximity of the Site which will allow it to respond to an emergency at the Site within one hour of receiving notice of an emergency, including emergencies occurring during non-working hours. The Bidder shall provide a list of emergency phone numbers for such purposes. If the Bidder does not have such a presence, it may satisfy this requirement by sub-contracting with a sub-contractor that does have such a presence, provided that any such sub-contractor must be approved by the Owner, in its sole discretion, prior to the project pre-construction meeting.

6. Bidder will complete the Work for the following price:

Notes:

1. Bids shall include sales tax, where required, and all other applicable taxes and fees.

2. All specific cash allowances are included in the price(s) set forth and have been computed in accordance with Paragraph 11.02 of the General Conditions and Specification Section 012100 Allowances.

3. The following allowances shall be included in the Contractors bid:

   a. Brick unit cost allowance of $650.00 per thousand for face brick (see Spec Section 042000)

   b. Repair and Asphalt Paving of Rodgers Road – $30,000 (see Spec Section 012100 for Description)

4. Procurement of Special Inspections shall be accomplished by the Owner. Specification section 014533 – Special Inspections is included in the Contract Documents for Contractor coordination of the Special Inspections.

Lump Sum Base Bid of:

$_____ in numbers

and _____ in words.

7. Bidder agrees that the Work will be substantially complete within _240_ calendar days after the date when the Contract Times commence to run as provided in paragraph 2.03 (A) of the General Conditions, and completed and ready for final payment in accordance with Article 14 of the General Conditions within _285_ calendar days after the date when the Contract Times commence to run.

   The terms used in this Bid with initial capital letters have the meanings indicated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

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

   _____

   _____

   _____

   _____

9. The terms in this Bid, which are defined in the General Conditions included as part of the Contract Documents, have the meanings assigned to them in the General Conditions.

10. Proposed Subcontractors:

    a. The Bidder's proposed subcontractors shall be listed below for the various branches of work included in the proposed contract. All subcontractors are subject to the approval of the Owner.

    b. **Unless rejected or otherwise permitted by the Owner, no substitutions or changes to the listing of the entities proposed to perform that branch of the work will be allowed following opening of the Bids.**

    c. Where Bidder proposes to perform the branch of work with its own forces, the phrase "Prime Contractor" shall be entered in the box provided.

    d.

Branch of Work	**Name of Subcontractor**
1. Electrical	
2. Instrumentation/SCADA	

    Failure to submit a complete list shall be cause for rejection of the Bid.

11. Proposed Major Equipment Manufacturers:

a. The Bidder's proposed major equipment manufacturers included in its Base Bid price shall be listed below for the requested items. **For the purposes of determining low bidder, the Bidder shall include only manufacturers named in the specification. Substitute "or equal" manufacturers will be considered after the Bid.** The Owner reserves the right to reject any equipment manufacturers not listed in the Specification.

b. Unless rejected or otherwise permitted by the Owner, no substitutions or changes to the listing of the major equipment manufacturers will be allowed following opening of the Bids.

c.

Major Equipment Item	**Name of manufacturer**
1. Chemical Metering Pumps	
2. Chemical Transfer Pumps	
3. Chemical Storage Tanks	

Failure to submit a complete list shall be cause for rejection of the Bid.

SIGNATURE OF BIDDER

If an Individual

Name (typed or printed): _____

By _____ (SEAL)
(Individual's signature)

doing business as _____

Business address _____

_____

Phone No.: _____ Fax No.: _____

Date _____

If a Partnership

Partnership Name: _____ (SEAL)

By _____
(Signature of general partner - attach evidence of authority to sign)

Name (typed or printed): _____

Business address _____

_____

Phone No. _____ Fax No.: _____

Date _____

If a Corporation

Corporation Name: _____ (SEAL)

State of Incorporation: _____

Type (General, Professional Service): _____

By _____
(Signature - attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

(CORPORATE SEAL)

Attest _____

Business address _____

_____

Phone No. _____ Fax No.: _____

Date _____

If a Limited Liability Company

Company Name: _____ (SEAL)

State of Organization: _____

Type (General, Professional): _____

By _____
Signature of Member or Manager (as applicable)- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

(COMPANY SEAL)

Attest _____

Business address _____

_____

Phone No. _____ Fax No.: _____

Date _____

If a Joint Venture

(Each joint venturer must sign. The manner for signing for each individual, partnership, and corporation that is party to the joint venture should be in the manner indicated above.)

Joint Venturer Name: _____ (SEAL)

By: _____
(Signature - attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

_____

Phone No.: _____ Fax No.: _____

Date _____

Joint Venturer Name: _____ (SEAL)

By: _____
(Signature - attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

_____

Phone No.: _____ Fax No.: _____

Date _____

BID BOND

BIDDER (Name and Address):

_____
_____
_____

SURETY (Name and Address of Principal Place of Business):

_____
_____
_____

OWNER (Name and Address):

_____
_____
_____

BID

BID DUE DATE: _____

PROJECT (Brief Description Including Location):

_____
_____
_____

BOND

BOND NUMBER: _____

DATE (Not later than Bid due date): _____

PENAL SUM: _____ _____
(Words) (Figures)

IN WITNESS WHEREOF, Surety and Bidder, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER	SURETY
_____(Seal)	_____(Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature and Title	Signature and Title (Attach Power of Attorney)
Attest: _____	Attest: _____
Signature and Title	Signature and Title

Note: (1) Above addresses are to be used for giving required notice.
(2) Any singular reference to Bidder, Surety, OWNER or other party shall be considered plural where applicable.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to OWNER upon default of Bidder the penal sum set forth on the face of this Bond.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by OWNER) the executed Agreement required by the Bidding Documents and any performance and payment Bonds required by the Bidding Documents.

3. This obligation shall be null and void if:
   3.1. OWNER accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by OWNER) the executed Agreement required by the Bidding Documents and any performance and payment Bonds required by the Bidding Documents, or
   3.2. All Bids are rejected by OWNER, or
   3.3. OWNER fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default by Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from OWNER, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of and any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by OWNER and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power or Attorney evidencing the authority of the officer, agent or representative who executed this Bond on behalf of Surety to execute, seal and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer or proposal as applicable.

BIDDER'S QUALIFICATIONS QUESTIONNAIRE

The undersigned guarantees the accuracy of all statements and answers herein contained. (Please print in ink).

1. How many years has your firm been in business as a General Contractor? _____

2. List three (3) projects of this nature that you have completed and give the name, address, and telephone number of a reference from each. Also give the completed cost of each project listed.

_____

_____

_____

_____

_____

_____

3. List projects presently under construction by your firm, dollar volume of the contract, and the percent of completion.

_____

_____

_____

_____

4. Have you ever failed to complete work awarded to you? If so, state where and why.

_____

_____

_____

_____

_____

5. Do you plan to sublet any part of this work? If so, give details.

_____

_____

_____

_____

6. What equipment do you own that is available for this work?

_____

_____

_____

_____

_____

7. What equipment do you plan to rent or purchase for this work?

_____

_____

_____

8. Have you ever performed similar work under the direction of a Consulting Engineer or Registered Architect? If so, list three (3) such firms giving the name of the firm, its address, telephone number and the name of the project. (List most recent project.)

_____

_____

_____

9 . Give the name, address, and telephone number of an individual who represents each of the following who the Owner may contact to investigate your financial responsibility: A surety, a bank and a major material supplier.

_____

_____

_____

_____

_____

10. Give a summary of your financial statement. (List assets and liabilities; use an insert sheet, if desired).

_____

_____

_____

_____

_____

_____

_____

_____

Respectfully submitted,

_____
Signature

_____
Title

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Section 004600

NON-COLLUSION AFFIDAVIT

STATE OF: _____)

COUNTY OF: _____) SS

_____, being first duly sworn, deposes

and says that it/its is the _____ of
(sole owner, a partner, president, secretary, etc.)

_____, the party making the foregoing bid; that such bid is genuine and not collusive or sham; that said bidder is not financially interested in, or otherwise affiliated in a business way with any other bidder on the same contract; that said bidder has not colluded, conspired, connived, or agreed, directly or indirectly, with any bidder or person, to put in a sham bid, or that such other person shall refrain from bidding, and has not in any manner directly or indirectly sought by agreement or collusion, or communication or conference, with any person, to fix the price or affidavit of any other bidder, or that of any other bidder, or to secure any advantage against Owner, or any person or persons interested in the proposed Contract; and that all statements contained in said bid are true; and further, that such bidder has not, directly or indirectly submitted this bid, or the contents thereof, or divulged information of data relative thereto to any association or to any member or agent thereof.

_____
AFFIANT

Sworn to and subscribed before me, a Notary Public in and for the above named

State and County, this _____ day of _____, 20 _____.

_____
NOTARY PUBLIC

End of Section

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Section 004610

REQUIRED NOTARIZED AFFIDAVIT FOR BIDDERS, OFFERORS AND CONTRACTORS CLAIMING KENTUCKY RESIDENT BIDDER STATUS

Bid Description: Dudley Complex Sodium Hypochlorite Building

FOR BIDS AND CONTRACTS IN GENERAL:
The bidder or offeror hereby swears and affirms under penalty of perjury that, in accordance with KRS 45A.494(2), the entity bidding is an individual, partnership, association, corporation, or other business entity that, on the date the contract was first advertised or announced as available for bidding:

1. Is authorized to transact business in the Commonwealth of Kentucky; AND
2. Has for one year prior to and through the date this contract was first advertised or announced as available for bidding:
    a. Filed Kentucky corporate income taxes;
    b. Made payments to the Kentucky unemployment insurance fund established in KRS 341.490; and
    c. Maintained a Kentucky workers' compensation policy in effect.

The undersigned acknowledges that the District reserves the right to request documentation supporting a bidder's claim of resident bidder status. Failure to provide such documentation upon request shall result in disqualification of the bidder or contract termination.

_____ _____
Signature Printed Name

_____ _____
Title (if signing on behalf of an entity) Date

State of _____)
)ss.
County of _____)

Subscribed and sworn to before me by _____, as the _____, of _____, this _____ day of _____, 20____.

_____
Notary-at-Large
My comm. exp.:_____

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Section 005000

AGREEMENT

THIS AGREEMENT is made and entered by and between the Northern Kentucky Water District (herein called Owner) and _____ (herein called Contractor).

Owner and Contractor, in consideration of the mutual covenants herein set forth, agree as follows:

Article 1. WORK.

Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

The construction of a new sodium hypochlorite chemical feed building, the demolition of an existing chemical feed building, the installation of buried chemical feed piping, a precast concrete chemical feed vault, and chemical feed taps to existing water mains. The new sodium hypochlorite building will include a bulk storage tank, transfer pumps, day storage tanks, metering pumps, associated chemical feed piping, valves and accessories, and associated electrical and instrumentation work.

Article 2. ENGINEER.

The Project has been designed by GRW Engineers, Inc., 801 Corporate Drive, Lexington, Kentucky, 40503, who is referred to in the Contract Documents as Engineer. Engineer, and its duly authorized agents, are to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

Article 3. CONTRACT TIMES, LIQUIDATED DAMAGES, DELAYS, AND DAMAGES.

All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

3.1. Contract Times. The Work will be substantially completed within 240 days after the date when the Contract Times commence to run as provided in paragraph 2.03.A of the General Conditions, and completed and ready for final payment in accordance with Article 14 of the General Conditions within 285 days after the date when the Contract Times commence to run.

3.2. Liquidated Damages. Owner and Contractor recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in paragraph 3.1 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expenses, and difficulties involved in proving in a legal proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay Owner $750.00

for each day that expires after the time specified in paragraph 3.1 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times or any proper extension thereof granted by Owner, Contractor shall pay Owner as liquidated damages (but not as a penalty) $500.00 for each day that expires after the time specified in paragraph 3.1 for completion and readiness for final payment until the Work is completed and ready for final payment.

Owner shall have the right to deduct the liquidated damages from any money in its hands, otherwise due, or to become due, to Contractor, or to initiate action to recover liquidated damages for nonperformance of this Contract within the time stipulated.

3.3. Delays and Damages. In the event Contractor is delayed in the prosecution and completion of the Work because of any delays caused by Owner or Engineer, Contractor shall have no claim against Owner or Engineer for damages (including but not limited to acceleration costs or damages) or contract adjustment other than an extension of the Contract Times and the waiving of liquidated damages during the period occasioned by the delay.

Contractor shall provide advance written notice to Owner and Engineer of Contractor's intention to accelerate the Work prior to commencing any acceleration. Such written notice shall include a detailed explanation of the nature and scope of the acceleration, the reason for the acceleration, the anticipated duration of the acceleration, and the estimated additional costs to Contractor, if any, related to the acceleration. This requirement shall not in any way affect or alter the agreement of Owner and Contractor with respect to delays and damages as set forth above and in the General Conditions and Supplementary Conditions. Owner shall not be responsible or liable for any acceleration costs or damages.

Article 4. CONTRACT PRICE.

Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents funds a total amount of:

_____ ($_____)
(words) (figures)

as indicated in Contractor’s bid.

Article 5. PAYMENT PROCEDURES.

Contractor shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions and as modified by the Supplementary Conditions.

5.1. Progress Payments. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment as recommended by the Engineer monthly during construction as provided in the General Conditions. All progress payments will be on the basis of the progress of the work measured by the schedule of values established in accordance with paragraph 2.07.A of the General Conditions (and in the case of Unit Price Work based on the number of units completed).

5.2. Retainage. In addition to any amounts withheld from payment in accordance with Paragraph 14.02 of the General Conditions, Owner shall retain from progress payments amounts equal to the following percentages:

a. Ten percent (10%) of the amount of the Work completed. This amount may be reduced by the Owner in its sole and absolute discretion, if the project is substantially completed; and

b. Ten percent (10%) of the value of materials and equipment that are not incorporated in the Work but are delivered, suitably stored, and accompanied by documentation satisfactory to Owner as provided in paragraph 14.02.A.1 of the General Conditions. Retainage for stored materials and equipment will be released when the materials and equipment are incorporated in the Work.

All retainage will be paid to Contractor when the Work is completed and ready for final payment in accordance with paragraph 14.07.C of the General Conditions. Consent of the Surety shall be obtained before retainage is paid by Owner. Consent of the Surety, signed by an agent, must be accompanied by a certified copy of such agent's authority to act for the Surety.

5.3. Final Payment. Upon final completion and acceptance of the Work in accordance with paragraphs 14.07.B and 14.07. C. of the General Conditions, Owner shall pay the remainder of the Contract Price as provided in paragraph 14.07.B and 14.07.C.

Article 6. CONTRACTOR'S REPRESENTATION

In order to induce Owner to enter into this Agreement, Contractor makes the following representations:

a. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Contract Documents.

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

c. Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.

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

e. Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.

f. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

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

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

i. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

Article 7. CONTRACT DOCUMENTS.

The Contract Documents, which are incorporated as part of this Agreement, consist of the following:

A. This Agreement;
B. Performance Bond;
C. Payment Bond;
D. General Conditions;
E. Supplementary Conditions;
F. Prevailing Wage Requirements and Labor Provisions - Kentucky
G. Specifications (including Geotechnical Exploration Report);
H. Drawings consisting of a cover sheet and sheets numbered G-001 through I-802 inclusive, with each sheet bearing the following general title;
    Northern Kentucky Water District
    Dudley Complex Sodium Hypochlorite Building
I. Addenda (numbers ___ to ___, inclusive);
J. Exhibits to this Agreement (enumerated as follows):
    1. Notice of Award and Notice to Proceed;
    2. Contractor's Bid;
    3. Documentation submitted by Contractor prior to Notice of Award;
K. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
    1. Written Amendments;
    2. Work Change Directives;
    3. Change Orders.

There are no Contract Documents other than those listed above in this Article 7. The Contract Documents may only be amended, modified, or supplemented as provided in paragraph 3.04.A and 3.04.B of the General Conditions.

Article 8. COMPLIANCE WITH KENTUCKY LAW

Contractor represents and warrants that it has revealed to Owner any and all final determinations of a violation of KRS Chapters 136, 139, 141, 337, 338, 341, and 342 by Contractor or any subcontractor within the past five years. Contractor further represents and warrants that it and each of its subcontractors will remain in continuous compliance with the provisions of KRS Chapters 136, 139, 141, 337, 338, 341 and 342 for the duration of this Agreement. Contractor understands that its failure to reveal a final determination of a violation or to comply with the above statutory requirements constitutes grounds for cancellation of the Agreement and for disqualification of Contractor from eligibility for any contracts for a period of two years.

Article 9. EQUAL OPPORTUNITY

Unless exempted under KRS 45.590, during the performance of this Agreement, Contractor agrees as follows:

1. Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age forty (40) and over, disability, veteran status, or national origin;

2. Contractor will take affirmative action in regard to employment, upgrading, demotion, transfer, recruitment, recruitment advertising, layoff, termination, rates of pay or other forms of compensation, and selection for training, so as to ensure that applicants are employed and that employees during employment are treated without regard to their race, color, religion, sex, age forty (40) and over, disability, veteran status, or national origin;

3. Contractor will state in all solicitations or advertisements for employees placed by or on behalf of Contractor that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age forty (40) or over, disability, veteran status, or national origin;

4. Contractor will post notices in conspicuous places, available to employees and applicants for employment, setting forth the provisions of the nondiscrimination clauses required by this section; and

5. Contractor will send a notice to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding advising the labor union or workers' representative of Contractor's commitments under the nondiscrimination clauses.

Article 10. MISCELLANEOUS.

a. Terms used in this Agreement will have the meanings indicated in the General Conditions.

b. No assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are 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 or responsibility under the Contract Documents.

c. Owner and Contractor each binds itself, its partners, successors, assigns, and representatives to the other party hereto, its partners, successors, assigns, and representatives in respect of all covenants, agreements, and obligations contained in the Contract Documents.

d. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement. One counterpart each has been delivered to Owner, Contractor, Surety, and Engineer.

This Agreement will be effective on _____ (which is the Effective Date of the Agreement).

OWNER: Northern Kentucky Water District

_____

By:_____

Address for giving notices

2835 Crescent Springs Road
P.O. Box 18640
Erlanger, Kentucky 41018

CONTRACTOR:_____

By:_____

(Corporate Seal)

Address for giving notices

_____

_____

(If Contractor is a corporation, attach evidence of authority to sign.)

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NOTICE OF AWARD
Dudley Complex Sodium Hypochlorite Building

To: Contractor Name
Street Address
City, State, Zip

Description of Work: The proposed work is generally described, but not limited to the following:
Construction of improvements to demolish the existing building at the Dudley complex and constructing a new building to house the sodium hypochlorite equipment. The project will also include a new buried chemical feed piping and electrical connections to the existing pumping station.

The Owner represented by the undersigned has considered the Bid submitted by you on April 30, 2015 for the above described work in response to its Invitation to Bid and Instructions to Bidders.

It appearing that it is to the best interest of said Owner to accept your Bid in the amount of in words ($ in figures), you are hereby notified that your Bid has been accepted for the above referenced project. You are required by the Notice and Instructions to Bidders to execute the formal Agreement with the undersigned Owner and to furnish the required Contractor's Performance and Payment Bond and proper Insurance Certificate within fifteen (15) days from the date of delivery of this Notice to you. **You are required to return an acknowledged copy of this Notice of Award and all copies of the signed Agreement (leave dates blank) to the Owner for execution.**

If you fail to execute said Agreement and to furnish said bonds and certificates within 15 days from the date of delivery of this Notice, said Owner will be entitled to consider all your rights arising out of the Owner's acceptance of your Bid as abandoned and as a forfeiture of your Bid Security. The Owner will be entitled to such other rights as may be granted by law and to award the work covered by your Bid to another, or to re-advertise the work or otherwise dispose thereof as the Owner may see fit.

Dated this _____ day of _____, 2015.

Owner
Northern Kentucky Water District

By:_____
Amy Kramer, Acting V.P. of Engineering, Production, & Distribution

ACCEPTANCE OF NOTICE
Receipt of the above Notice of
Award is hereby acknowledged this
_____day of _____,2015.

_____(contractor name)

By: _____

Title: _____

This page was left blank intentionally.

Northern Kentucky Water District

NOTICE TO PROCEED

Dudley Complex Sodium Hypochlorite

To: Contractor Name
Address
City, State Zip
Attention:

Date: ____, 2015

Description of Work: The proposed work is generally described, but not limited to the following: Construction of improvements to demolish the existing building at the Dudley complex and constructing a new building to house the sodium hypochlorite equipment. The project will also include a new buried chemical feed piping and electrical connections to the existing pumping station.

You are hereby notified to commence WORK in accordance with the agreement dated _____, 2015 on or before _____, 2015. The Work will need to be substantially completed within ____ calendar days after the date when the Contract Times commence to run as provided in paragraph 2.03 of the General Conditions, and completed and ready for final payment in accordance with paragraph 14.07.B of the General Conditions within ____ calendar days after the date when the Contract Times commence to run. Therefore, the date of Substantial Completion is _____, 201_, and the date of Final Completion is _____, 201_.

OWNER
Northern Kentucky Water District

By: _____
Amy Kramer
Acting V.P. Eng, Production & Distribution

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged this the _____ day of _____, 2015.

By: _____

_____
Title

2835 Crescent Springs Road P.O. Box 18640 Erlanger, KY 41018 (859) 578-9898 Fax (859) 578-5456

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PERFORMANCE BOND

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Address Principal Place of Business):

OWNER (Name and Address):

CONSTRUCTION CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
Date (Not earlier than Construction Contract Date):
Amount:
Modifications to this Bond Form:

CONTRACTOR AS PRINCIPAL
Company: **(Corp. Seal)**

Signature_____
Name and Title:

SURETY
Company: **(Corp. Seal)**

Signature_____
Name and Title:

CONTRACTOR AS PRINCIPAL
Company: **(Corp. Seal)**

Signature_____
Name and Title:

SURETY
Company: **(Corp. Seal)**

Signature_____
Name and Title:

EJCDC No. 1910 28 A(1996 Edition)
Originally prepared through the joint efforts of the Surety Association of America. Engineers Joint Contract Documents Committee. The Associated General Contractors of America and the American Institute of Architects.

1. The CONTRACTOR and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the OWNER for the performance of the Contract, which is incorporated herein by reference.

2. If the CONTRACTOR performs the Contract, the Surety and the CONTRACTOR shall have no obligation under this Bond, except to participate in conferences as provided in Subparagraph 3. 1.

3. If there is no OWNER Default, the Surety's obligation under this Bond shall arise after:

3.1. The OWNER has notified the CONTRACTOR and the Surety at its address described in Paragraph 10 below, that the OWNER is considering declaring a CONTRACTOR Default and has requested and attempted to arrange a conference with the CONTRACTOR and the Surety to be held not later than fifteen days after receipt of such notice to discuss methods of performing the Contract. If the OWNER, the CONTRACTOR and the Surety agree, the CONTRACTOR shall he allowed a reasonable time to perform the Contract, but such an agreement shall not waive the OWNERs right, if any, subsequently to declare a CONTRACTOR Default; and

3.2. The OWNER has declared a CONTRACTOR Default and formally terminated the CONTRACTOR's right to complete the contract. Such CONTRACTOR Default shall not be declared earlier than twenty days after the CONTRACTOR and the Surety have received notice as provided in paragraph 3. 1; and

3.3. The OWNER has agreed to pay the balance of the Contract Price to

3.3.1 The Surety in accordance with the terms of the Contract

3.3.2 Another contractor selected to pursuant to paragraph 4.3 to perform the Contract.

4. When the OWNER has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

4.1. Arrange for the CONTRACTOR, with consent of the OWNER, to perform and complete the Contract; or

4.2. Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or

4.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the OWNER for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by the OWNER and the contractor selected with the OWNER's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the Bonds issued on the Contract, and pay to the OWNER the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by the OWNER resulting from the CONTRACTOR's default; or

4.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

1. After investigation, determine the amount for which it may be liable to the OWNER and, as soon as practicable after the amount is determined, tender payment therefor to the OWNER; or
2. Deny liability in whole or in part and notify the OWNER citing reasons therefor.

5. If the Surety does not proceed as provided in Paragraph 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond fifteen days after receipt of an additional written notice from the OWNER to the Surety demanding that the Surety perform its obligations under this Bond, and the OWNER shall be entitled to enforce any remedy available to the OWNER. If the Surety proceeds as provided in paragraph 4.4, and the OWNER refuses the payment tendered or the Surety has denied liability, in whole or in part without further notice, the OWNER shall be entitled to enforce any remedy available to the OWNER.

6. After the OWNER has terminated the CONTRACTOR's rights to complete the Contract, and if the Surety elects to act under Subparagraph 4.1, 4.2 or 4.3 above, then the responsibilities of the Surety to the OWNER shall not be greater than those of the CONTRACTOR under the Contract and the responsibilities of the OWNER to the Surety shall not by greater than those of the OWNER under the Contract. To the limit of the amount of this Bond, but subject to commitment by the OWNER of the Balance of the Contract Price to mitigation of costs and damages on the Contract, the Surety is obligated without duplication for:

6.1. The responsibilities of the CONTRACTOR for correction of defective work and completion of the Contract;

6.2 . Additional legal, design professional and delay costs resulting from the CONTRACTOR's Default, and resulting from the actions or failure to act of the Surety under Paragraph 4; and

6.3 Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of the CONTRACTOR.

7. The Surety shall not be liable to the OWNER or others for obligations of the CONTRACTOR that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the OWNER or its heirs, executors, administrators, or successors.

8. The Surety hereby waives notice of any change including changes of time to the Contract or to related subcontracts, purchase orders and other obligations.

9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the Work or part of the Work is located and shall be instituted within two years after CONTRACTOR Default or within two years after the CONTRACTOR ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bonds, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to the Surety, the OWNER or the CONTRACTOR shall be mailed or delivered to the address shown on the signature page.

11. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

12. Definitions.

12.1. Balance of the Contract Price: The total amount payable by the OWNER to the CONTRACTOR under the Contract after all proper adjustments have been made, including allowance to the CONTRACTOR of any amounts received or to be received by the OWNER in settlement of insurance or other claims for damages to which the CONTRACTOR is entitled, reduced by all valid and proper payments made to or on behalf of the CONTRACTOR under the Contract.

12.2. Contract: The agreement between the OWNER and the CONTRACTOR identified on the signature page, including all Contract Documents and changes thereto.

12.3. CONTRACTOR Default: Failure of the CONTRACTOR, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.

12.4. OWNER Default: Failure of the OWNER which has neither been remedied nor waived, to pay the CONTRACTOR as required by the Contract or to perform and complete or comply with the other terms thereof.

(FOR INFORMATION ONLY - Name, Address and Telephone)
AGENT or BROKER: OWNER'S REPRESENTATIVE (Architect, Engineer or other party):

PAYMENT BOND

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address):

CONSTRUCTION CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
Date (Not earlier than Construction Contract Date):
Amount:
Modifications to this Bond Form:

Surety and Contractor intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	**(Corp. Seal)**	**Company:**	**(Corp. Seal)**
Signature_____		**Signature_____**	
Name and Title:		**Name and Title:**	
		(Attach Power of Attorney)	

(Space is provided below for signatures of additional parties, if required)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	**(Corp. Seal)**	**Company:**	**(Corp. Seal)**
Signature_____		**Signature_____**	
Name and Title:		**Name and Title:**	

EJCDC No. 1910 28 B (1996 Edition)
Originally prepared through the joint efforts of the Surety Association of America, Engineers Joint Contract Documents Committee, the Associated General Contractors of America, the American Institute of Architects, the American Subcontractors Association, and the Associated Specialty Contractors.

1. The CONTRACTOR and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Contract, which is incorporated herein by reference.

2. With respect to the Owner, this obligation shall be null and void if the CONTRACTOR:

2.1. Promptly makes payment, directly or indirectly, for all sums due Claimants, and

2.2. Defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity whose claim, demand, lien or suit is for payment for labor, materials or equipment furnished for use in the performance of the Contract, provided the Owner has promptly notified the CONTRACTOR and the Surety (at the address described in Paragraph 12) of any claims, demands, liens or suits and tendered defense of such claims, demands, liens or suits to the CONTRACTOR and the Surety, and provided there is no Owner Default.

3. With respect to Claimants, this obligation shall be null and void if the CONTRACTOR promptly makes payment, directly or indirectly, for all sums due.

4. The Surety shall have no obligation to Claimants under this Bond until:

4.1. Claimants who are employed by or have a direct contract with the CONTRACTOR have given notice to the Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

4.2. Claimants who do not have a direct contract with the CONTRACTOR:

1. Have furnished written notice to the CONTRACTOR and sent a copy, or notice thereof, to the Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied or for whom the labor was done or performed; and
2. Have either received a rejection in whole or in part from the CONTRACTOR, or not received within 30 days of furnishing the above notice any communication from the CONTRACTOR by which the CONTRACTOR has indicated the claim will be paid directly or indirectly; and
3. Not having been paid within the above 30 days, have sent a written notice to the Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof,. to the Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to the CONTRACTOR.

5. If a notice required by Paragraph 4 is given by the Owner to the CONTRACTOR or to the Surety that is sufficient compliance.

6. When the Claimant has satisfied the conditions of Paragraph 4, the Surety shall promptly and at the Surety's expense take the following actions:

6.1 Send an answer to the Claimant, with a copy to the Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and that basis for challenging any amounts that are disputed.

6.2 Pay or arrange for payment of any undisputed amounts.

7. The Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

8. Amounts owed by the Owner to the CONTRACTOR under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any Construction Performance Bond. By the CONTRACTOR furnishing and the Owner accepting this Bond, they agree that all funds earned by the CONTRACTOR in the performance of the Contract are dedicated to satisfy obligations of the CONTRACTOR and the Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

9. The Surety shall not be liable to the Owner, Claimants or others for obligations of the CONTRACTOR that are unrelated to the Contract. The Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

10. The Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders and other obligations.

11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the work or part of the work is located of after the expiration of one year from the date (1) on which the Claimant gave the notice required by Subparagraph 4.1 or Clause 4.2 (iii), or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to the Surety, the Owner or the CONTRACTOR shall he mailed or delivered to the address shown on the signature page. Actual receipt of notice by Surety, the Owner or the CONTRACTOR, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in the Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is, that this Bond shall he construed as a statutory bond and not as a common law bond.

14. Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the CONTRACTOR shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15. DEFINITIONS

15.1. Claimant: An individual or entity having a direct contract with the CONTRACTOR or with a subCONTRACTOR of the CONTRACTOR to furnish labor, materials or equipment for use in the performance of the Contract. "The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Contract, architectural and engineering services required for performance of the work of the CONTRACTOR and the CONTRACTOR's subCONTRACTORs, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

15.2. Contract: The agreement between the Owner and the CONTRACTOR identified on the signature page, including all Contract Documents and changes thereto.

15.3. Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the CONTRACTOR as required by the Contract or to perform and complete or comply with the other terms thereof.

(FOR INFORMATION ONLY-Name, Address and Telephone)

AGENT or BROKER: OWNER'S REPRESENTATIVE (Architect, Engineer or other party):

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APPLICATION FOR PAYMENT

Project No:
Project:

Application for Payment No.: _____
Period Beginning Date: _____
Period Ending Date: _____

Owner:

General Contractor:

CONTRACTOR AFFIDAVIT

The undersigned affiant states that he/she is the Authorized Signatory of the CONTRACTOR for the construction of the PROJECT. By his personal knowledge, he further states that the WORK covered by this APPLICATION FOR PAYMENT has been completed in accordance with the CONTRACT DOCUMENTS and executed amendments thereto; that for all previous APPLICATIONS FOR PAYMENT, except as noted hereinafter as exceptions, the CONTRACTOR has paid in full or has otherwise satisfied all obligations (1) for equipment and materials (whether incorporated into the WORK or acceptably stored on-site), (2) for all work, labor, and services performed, and (3) for all known indebtedness and claims against the CONTRACTOR for damages arising in any manner in connection with the performance of this CONTRACT for which the OWNER, the OWNER's property, or the CONTRACT funds might in any way be held responsible, including the applicable State Statute, and that the current payment on this APPLICATION FOR PAYMENT is now due and payable. This affidavit is directed to the OWNER by and through its ENGINEER.

EXCEPTIONS: _____ (If none, write "NONE". Attach additional sheets, if necessary.)
If required by the OWNER, the CONTRACTOR shall furnish a bond satisfactory to the OWNER for each exception)

_____ _____
CONTRACTOR **DATE**

State of: _____ County of: _____

SUBSCRIBED and sworn to before me by _____ on this _____ day of _____, 20____.

_____ My Commission expires: _____
NOTARY PUBLIC

STATEMENT BY ENGINEER

BASED upon on-site observation, and to the best of my knowledge, understanding, and belief, the WORK has progressed to the point indicated herein; and the quality of the WORK complies with the requirements of the CONTRACT DOCUMENTS.

_____ _____
ENGINEER **DATE**

APPLICATION FOR PAYMENT SUMMARY

TOTAL WORK COMPLETED TO DATE	$0.00	ORIGINAL CONTRACT PRICE	$0.00
BALANCE OF STORED MATERIALS	0.00	CHANGE ORDER NO 1	
TOTAL ENTITLEMENT TO DATE	$0.00	CHANGE ORDER NO 2	
AMOUNT RETAINED PER CONTRACT (10%)	0.00	CHANGE ORDER NO 3	
CLAIMS AGAINST THE CONTRACT FUNDS	0.00	CHANGE ORDER NO 4	
TOTAL DUE CONTRACTOR TO DATE	$0.00	CHANGE ORDER NO 5	
AMOUNT OF PREVIOUS PAYMENTS		TOTAL CONTRACT PRICE TO DATE	$0.00
AMOUNT DUE CONTRACTOR THIS PAYMENT	$0.00	Percent Complete (Excluding Stored Materials)	

AUTHORIZATION BY OWNER

_____ _____
OWNER **DATE**

Attachments: Cost Breakdown
Stored Material Breakdown (if applicable)

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COST BREAKDOWN

Project No.:
Project:

Application for Payment No.:
Period Beginning Date:
Period Ending Date:

Item		Breakdown				Completed Previously		Completed This Month		Completed To Date		Percent
No.	Description of Work	Quantity	Unit	Unit Price	Total	Quantity	Amount	Quantity	Amount	Quantity	Amount	Complete
BASE BID												
					0.00		0.00		0.00	0.00	0.00	
					0.00		0.00		0.00	0.00	0.00	
					0.00		0.00		0.00	0.00	0.00	
					0.00		0.00		0.00	0.00	0.00	
					0.00		0.00		0.00	0.00	0.00	
					0.00		0.00		0.00	0.00	0.00	
					0.00		0.00		0.00	0.00	0.00	
					0.00		0.00		0.00	0.00	0.00	
					0.00		0.00		0.00	0.00	0.00	
					0.00		0.00		0.00	0.00	0.00	
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					0.00		0.00		0.00	0.00	0.00	
					0.00		0.00		0.00	0.00	0.00	
					0.00		0.00		0.00	0.00	0.00	
CHANGE ORDERS												
					0.00		0.00		0.00	0.00	0.00	
					0.00		0.00		0.00	0.00	0.00	
					0.00		0.00		0.00	0.00	0.00	
					0.00		0.00		0.00	0.00	0.00	
				Total Base Bid	$0.00		$0.00		$0.00		$0.00	

MATERIALS STORED BREAKDOWN

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Project No.:
Project:

Application for Payment No.:
Period Beginning Date:
Period Ending Date:

			A	B	C	D	
Bid Item No.	Invoice #	Material Description	Materials stored last period	Materials purchased this period	Total (A+B)	Materials used this period	Materials currently stored (C-D)
					$0.00		$0.00
					0.00		0.00
					0.00		0.00
					0.00		0.00
					0.00		0.00
					0.00		0.00
					0.00		0.00
					0.00		0.00
					0.00		0.00
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					0.00		0.00
					0.00		0.00
					0.00		0.00
					0.00		0.00
					0.00		0.00
					0.00		0.00
					0.00		0.00
		TOTALS	$0.00	$0.00	$0.00	$0.00	$0.00

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Change Order

Date: **Change Order No.:**
Project: **Project No.:**

Owner: **Contractor:**

The Contractor is hereby directed to perform the **Work** described in the **Contract For Construction** as amended by the **Change Order**:

Attachments: **TOTAL:** **$0.00**

Original Contract Amount	
Net Change by Previous Change Orders	
Contractor Amount Prior to This Change Order	0.00
Amount of This Change Order	0.00
New Contract Amount	$0.00

The Substantial Completion Date:

This **Change Order** is intended to, and the **Contractor** agrees that it does, fairly and adequately compensate the **Contractor** for extra direct costs (labor, materials, etc.) as well as all expenses and damages which may result from any delays, suspensions, stretch-outs, scheduling, inefficiencies, and accelerations in the Work associated with this Change Order, and the Contractor releases the Owner and the Engineer from any claims for such expenses and damages, including but not limited to changes in sequence of work; delays; disruption; rescheduling; extended overhead; acceleration; wage; material; or other escalations; and all other impact costs.

This **Change Order** is intended to, and the **Contractor** agrees that it does, provide the **Contractor** a reasonable and adequate period of time in which to complete the Work in accordance with the Contract For Construction, as amended by this Change Order, and the Contractor releases the Owner and the Engineer from any claims for additional time to perform the Work.

OWNER **DATE** **CONTRACTOR** **DATE**

cc:

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CERTIFICATE OF INSURANCE

Issue Date:

PRODUCER:

Code Sub-Code

INSURED:

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

COMPANIES AFFORDING COVERAGE

COMPANY LETTER A	
COMPANY LETTER B	
COMPANY LETTER C	
COMPANY LETTER D	
COMPANY LETTER E	

COVERAGES

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES.

CO LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE	POLICY EXPIRATION DATE	ALL LIMITS IN THOUSANDS	
	GENERAL LIABILITY				GENERAL AGGREGATE	$1,000,
	[X] COMMERCIAL GENERAL LIABILITY				PRODUCTS-COMP/OPS AGGREGATE	$1,000,
	[X] OCCURRENCE	(Completed Operations & Products Liability remains			PERSONAL & ADVERTISING INJURY	$1,000,
	[X] BLANKET CONTRACTUAL	in force for 2 years after final payment)			EACH OCCURRENCE	$1,000,
	[ ] _____					
	AUTOMOBILE LIABILITY					
	[X] ANY AUTO				COMBINED SINGLE LIMIT EACH OCCURRENCE Bodily Injury & Property Damage	$1,000,
	[X] HIRED AUTOS					
	[X] NON-OWNED AUTOS					
	EXCESS LIABILITY				EACH OCCURRENCE	$4,000,
	[X] UMBRELLA FORM	(Follows Form of the Primary)			AGGREGATE	$4,000,
	WORKERS' COMPENSATION AND EMPLOYERS' LIABILITY				STATUTORY	
					EACH ACCIDENT	$1,000,
		(Includes US Longshoremen and Harbor Workers Act and Maritime Coverage Where Applicable and All States Endorsement)			DISEASE-POLICY LIMIT	$1,000,
					DISEASE-EACH EMPLOYEE	$1,000,
	OTHER				EACH OCCURRENCE	
	[ ] _____				AGGREGATE	

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/SPECIAL ITEMS:

1. Certificate Holder(s) & their Officers, Directors, Partners, Employees, & Agents Named as Additional Insured (all policies except WC). The coverage afforded the Additional Insured under these policies shall be primary insurance. If the Additional Insured has other insurance which is applicable to the loss, such other insurance shall be on an excess or contingent basis. (Copy of Additional Insured Endorsement attached.)
2. Blanket Coverage for XCU Hazards (General Liability & Excess Liability).
3. Waiver of Subrogation Against Certificate Holder(s), Their Officers, Directors, Partners, Employees, & Agents (all policies).
4. Contractual Coverage covers liability assumed in the Indemnification Clause of the Contract between Certificate Holder and Insured (General Liability & Excess Liability).
5. General and Products/Completed Operations aggregates apply for each Certificate Holder contract(s) or amendments (General Liability & Excess Liability).
6. Contractual Liability Limitation Endorsement CG2139 or its equivalent is not included in either General or Excess Liability policies.
7. Severability of Interest or Cross Liability clause or endorsement included (General Liability & Excess Liability).

CERTIFICATE HOLDERS	CANCELLATION
1.	SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELED, TERMINATED, OR MATERIALLY CHANGED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING COMPANY WILL MAIL 30 DAYS' WRITTEN NOTICE TO THE CERTIFICATE HOLDERS NAMED TO THE LEFT. ANY IMPAIRMENT OR EXHAUSTION OF AGGREGATES WILL BE THE SUBJECT OF IMMEDIATE NOTICE TO THE CERTIFICATE HOLDERS.
2.	AUTHORIZED REPRESENTATIVE

This page was left blank intentionally.

CERTIFICATE OF PROPERTY INSURANCE

ISSUE DATE _____ (mm/dd/yy)

THIS IS EVIDENCE THAT INSURANCE AS IDENTIFIED BELOW HAS BEEN ISSUED IS IN FORCE AND CONVEYS ALL THE RIGHTS AND PRIVILEGES AFFORDED UNDER THE POLICY

PRODUCER	COMPANY
Code Sub-Code	
INSURED	POLICY NUMBER
	EFFECTIVE DATE (mm/dd/yy) / EXPIRATION DATE (mm/dd/yy)

PROPERTY INFORMATION

LOCATION/DESCRIPTION

COVERAGE INFORMATION

COVERAGES/PERILS/FORMS	AMOUNT OF INSURANCE	DEDUCTIBLE
BUILDERS RISK/INSTALLATION FLOATER All Risk of Physical Damage or Loss to Equipment and Materials at or Incidental to the Jobsite on Completed Value Form	Insurable value of completed work.	

REMARKS (Including Special Conditions)

1 Certificate Holder and others identified in the property insurance paragraph of the Contract Documents are Named Insureds
2 Waiver of Subrogation against Named Insureds
3 Any similar insurance carried by Named Insureds is excess of coverage described hereon
4 Losses are payable to Owner as fiduciary for the Named Insureds

CANCELLATION

THIS POLICY IS SUBJECT TO THE PREMIUMS FORMS AND RULES IN EFFECT FOR EACH POLICY PERIOD SHOULD THE POLICY BE TERMINATED OR MATERIALLY CHANGED THE COMPANY WILL GIVE THE CERTIFICATE HOLDERS IDENTIFIED BELOW 30 DAYS' WRITTEN NOTICE AND WILL SEND NOTIFICATION OF ANY CHANGES TO THE POLICY THAT WOULD AFFECT THAT INTEREST IN ACCORDANCE WITH THE POLICY PROVISIONS OR AS REQUIRED BY LAW

CERTIFICATE HOLDERS

Name and Address	Nature of Interest
1	X Additional Named Insured
2	SIGNATURE OF AUTHORIZED AGENT OF THE COMPANY

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly by

ACEC
American Council of Engineering Companies

The Associated General Contractors of America
Skill Responsibility Integrity

ASCE American Society of Civil Engineers

National Society of Professional Engineers
Professional Engineers in Private Practice

AMERICAN COUNCIL OF ENGINEERING COMPANIES

_____

ASSOCIATED GENERAL CONTRACTORS OF AMERICA

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PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
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CSI

CONSTRUCTION SPECIFICATIONS INSTITUTE

Conformance Set

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed 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. *Bidder*—The individual or entity who submits a Bid directly to Owner.

7. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).

8. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.

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*—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions 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 Milestones, if any; (ii) achieve Substantial Completion; and (iii) 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.

16. *Cost of the Work*—See Paragraph 11.01 for definition.

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. *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.

21. *General Requirements*—Sections of Division 1 of the Specifications.

22. *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.

23. *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.

24. *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.

25. *Liens*—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

26. *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.

27. *Notice of Award*—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.

28. *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.

29. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

30. *PCBs*—Polychlorinated biphenyls.

31. *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.

32. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

33. *Project*—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

34. *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.

35. *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.

36. *Resident Project Representative*—The authorized representative of Engineer who may be assigned to the Site or any part thereof.

37. *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.

38. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

39. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

40. *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.

41. *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.

42. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

43. *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.

44. *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.

45. *Successful Bidder*—The Bidder submitting a responsive Bid to whom Owner makes an award.

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

47. *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 Subcontractor.

48. *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.

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

50. *Work*—The entire 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.

51. *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.

1.02 *Terminology*

A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, 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 exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the 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 is not intended to and 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 9.09 or any other provision of the Contract Documents.

C. *Day:*

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

a. does not conform to the Contract Documents; or

b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

c. 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).

E. *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.

F. Unless stated otherwise in the Contract Documents, words or phrases that 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 and Evidence of Insurance*

A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *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.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. 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. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for 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 Submittals; 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.

2.06 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, 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.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.07 *Initial Acceptance of Schedules*

A. At least 10 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.A. Contractor shall have an additional 10 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 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 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 required by one is as binding as if required 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 reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated 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.

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. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, 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. *Contractor's Review of Contract Documents Before Starting Work*: 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 discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.

2. *Contractor's Review of Contract Documents During Performance of Work*: 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 (a) any applicable Law or Regulation , (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. 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.

3. 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 had actual knowledge 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, or code, or the instruction of any Supplier (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 by either a Change Order or 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:

1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or

3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

1. 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 its consultants, including electronic media editions; or

2. reuse any 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 adaptation by Engineer.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL 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 or a part thereof, 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 known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the 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 or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors 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 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 9.07 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 with respect to 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 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, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall 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 provided by others; 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 or 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:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the 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 or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors 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.A); 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. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

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 written notice to Contractor: (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, and Engineer, and the officers, directors, members, partners, employees, agents, 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.G 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 and Engineer, and the officers, directors, members, partners, employees, agents, 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.H 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 do not 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 of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, 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 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 or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.

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 promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide 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 and loss payee 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.

B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee 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.

C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor’s obligation to maintain such insurance.

D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.

E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor’s liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor’s Insurance*

A. Contractor shall purchase and maintain such 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:

   a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

   b. 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 required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, 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, members, partners, employees, agents, 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;

2. 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 contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;

4. contain a provision or endorsement that the coverage afforded will not be canceled, 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 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);

5. 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

6. include completed operations coverage:

   a. Such insurance shall remain in effect for two years after final payment.

   b. 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.

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, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;

   2. be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, 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 (other than that caused by flood), 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 loss payee to whom a certificate of insurance has been issued.

B. Owner shall purchase and maintain such equipment breakdown 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, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee.

C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this 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 loss payee 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 this Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. 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, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, 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 loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, 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 and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, 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, and Engineer, and the officers, directors, members, partners, employees, agents, 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 perils 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, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.

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 loss payees, 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.

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 2.01.B. 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.

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. 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.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

6.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction 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. Contractor will not permit the performance of Work on a 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 Contract Documents, 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 special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

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. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

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:

        1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

        2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and

        3) it has a proven record of performance and availability of responsive service.

    b. Contractor certifies that, if approved and incorporated into the Work:

        1) there will be no increase in cost to the Owner or increase in Contract Times; and

        2) it will conform substantially 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 if 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 requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.

    d. Contractor shall 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:

        1) shall certify that the proposed substitute item will:

            a) perform adequately the functions and achieve the results called for by the general design,

b) be similar in substance to that specified, and

c) be suited to the same use as that specified;

2) will state:

a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,

b) whether 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 other work on the Project) to adapt the design to the proposed substitute item, and

c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

3) will identify:

a) all variations of the proposed substitute item from that specified, and

b) available engineering, sales, maintenance, repair, and replacement services; and

4) shall 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.

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is 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 requirements for review by Engineer will be similar to those provided in Paragraph 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 may require Contractor to furnish additional data about the proposed substitute item. 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 a Change Order in the case of a substitute and 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 Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not

Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

F. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

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. 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:

1. 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

2. shall 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 a loss payee 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, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, 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.

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.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors 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 specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, 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 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. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

A. Contractor shall give all notices required by and shall 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 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 shall 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 and Engineer, and the officers, directors, members, partners, employees, agents, 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 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 the Work 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, 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. Such responsibility does not relieve

Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. 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.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

E. 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 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 other individual or entity directly or indirectly employed by any of them).

F. 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 and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

a. Submit number of copies specified in the General Requirements.

b. 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.D.

2. *Samples:*

a. Submit number of Samples specified in the Specifications.

b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, 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.

C. *Submittal Procedures:*

1. Before submitting each Shop Drawing or Sample, Contractor shall have:

   a. 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;

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

   c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

   d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

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

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. *Engineer's Review:*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of 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 shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.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. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *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.

6.18 *Continuing the Work*

A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.

B. 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.

C. 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 review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

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

7. 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 and Engineer, and the officers, directors, members, partners, employees, agents, 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 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 but only to the extent caused 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 .

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors 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 officers, directors, members, partners, employees, agents, consultants and subcontractors 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.

6.21 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services

are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or through 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, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. 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 such work; provided, however, that Contractor may cut or alter others' 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 such 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.

7.03 *Legal Relationships*

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.

C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

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 When Due*

A. Owner shall make payments to Contractor 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 with respect to 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 relating to existing surface or subsurface structures at the Site.

8.06 *Insurance*

A. Owner's responsibilities, if any, with 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 with 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. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

8.12 *Compliance with Safety Program*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

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.

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 9.09. 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 authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. 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 *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 or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties 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.

9.05 *Rejecting Defective Work*

A. Engineer will have authority to 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.

9.06 *Shop Drawings, Change Orders and Payments*

A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *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.

9.08 *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. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.

B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.

D. When functioning as interpreter and judge under this Paragraph 9.08, 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.

9.09 *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 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.10 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Contract 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 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).

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.D.

10.03 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer 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 the provisions of any bond require notice to be given to a surety 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), 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*

A. *Engineer's Decision Required*: All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.

B. *Notice:* Written notice stating the general nature of each Claim 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. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, 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). 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 Times 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).

C. *Engineer's Action*: Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

1. deny the Claim in whole or in part;

2. approve the Claim; or

3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; 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, except those excluded in Paragraph 11.01.B, 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 not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:

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, superintendents, foremen, and other personnel employed full time on the Work. 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, as 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, express and courier services, and similar petty cash items in connection with the Work.

i. 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, safety 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 Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to 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, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. 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, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 *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 and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances:*

1. Contractor agrees that:

a. the cash 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

b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash 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.

C. *Contingency Allowance:*

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. 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.

B. 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 9.07.

C. 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.

D. 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. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

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. 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 Paragraphs 12.01.C.2.a and 12.01.C.2.b 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 may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times 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 covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times 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.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an

equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors 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.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for 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.

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. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

A. Owner, Engineer, their consultants and 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, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's 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 Paragraph 13.04.C; and

3. as otherwise specifically provided in the Contract Documents.

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, Contractor shall, if requested by Engineer, uncover such Work 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.

C. If it is found that the uncovered 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.

D. If the uncovered 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 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.

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. Promptly after receipt of written notice, 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).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

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 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:

1. repair such defective land or areas; or

2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. 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.

B. If Contractor does not promptly comply with the terms of Owner's written 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. 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.

C. 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.

D. 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.

E. 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 for 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, or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or 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 Contractor, 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 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 in the Agreement 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.

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 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, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and 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:

   a. 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

b. 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:

   a. to supervise, direct, or control the Work, or

   b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

   c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

   d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

   e. 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 stated 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 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 will 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 remedies the reasons for such action.

3. Upon a subsequent determination 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 and subject to interest as provided in the Agreement.

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.

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.

B. Promptly after Contractor's notification, 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.

C. If Engineer considers the Work substantially complete, Engineer will 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 definitive 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.

D. 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.

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy 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, subject to the following conditions:

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.

2. 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.

3. 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, 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.

4. No use or 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.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;

   b. consent of the surety, if any, to final payment;

   c. a list of all Claims against Owner that Contractor believes are unsettled; and

   d. 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 might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, 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. *Engineer's 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, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

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 (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, 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 accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

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 granted 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 repeated 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 surety) seven days written notice of its intent to terminate the services of Contractor:

1. 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);

2. 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

3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. 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 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.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

E. 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.

F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

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, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. 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. 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. 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. 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, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on

any Application for Payment within 30 days after it is submitted, or (iii) 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.

B. 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. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or

2. agrees with the other party to submit the Claim to another dispute resolution process; or

3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

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:

1. 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

2. 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. 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 Contract or termination of the services of Contractor.

17.05 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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Section 007300

NKWD SUPPLEMENTARY CONDITIONS

SCOPE. These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (007200, 2007 Edition) and other provisions of the Contract Documents as indicated herein. All provisions which are not so amended or supplemented remain in full force and effect.

SC-1. DEFINITIONS AND TERMINOLOGY.

SC-1.01. DEFINED TERMS. The terms used in these Supplementary Conditions which are defined in the Standard General Conditions of the Construction Contract (C-700, 2007 Edition) have the meanings assigned to them in the General Conditions.

Amend the terms as follows:

3. Application for Payment: Strike out the word “Engineer” and insert the word “Owner” in its place.

9. Change Order: Strike out the words “recommended by Engineer”.

12. Contract Documents: In the first sentence, strike out the word “Engineer’s” and insert the word “Owner’s” in its place.

15. Contract Times: Strike out the words “as evidenced by Engineer’s written recommendation of final payment”.

16. Delete the term “Contractor” and substitute therefore the terms “Contractor or Prime Contractor.”

17. Add the following sentence to the definition: “Drawings may also be described as Plans.”

20. Field Order: Strike out the word “Engineer” and insert the word “Owner” in its place.

22. Delete the words “ or Radioactive Material” and substitute therefore the words “Radioactive Material or other pollutants or contaminants”.

44. Substantial Completion: Strike out the word “Engineer” and insert the word “Owner” in its place. Add the following to the first sentence: "and a Certificate of Substantial Completion has been completed."

51. Work Change Directive: In the first sentence strike out the words “and recommended by Engineer”.

Additional terms used in these Supplementary Conditions have the meanings indicted herein, which are applicable to both the singular and plural thereof.

Add the following new definitions to paragraph 1.01:

"52. Final Completion – The time when all work is complete, including all punch list items, and all documents required for occupancy of the facility are completed and submitted to the OWNER. These documents include, but are not limited to, Certificate of Occupancy, Letters of Approval from various regulatory agencies, inspection certificates, and all other items as required in paragraph 14.07."

"53. General Contractor – The person, firm, or corporation with whom OWNER has entered into an Agreement for a complete project, general trades, or complete project less a part of the project."

"54. Without exception – The term "without exception", when used in the Contract Documents following the name of a Supplier or a proprietary item of equipment, product, or material, shall mean that the sources of the product are limited to the listed Suppliers or products and that no like, equivalent, or "or-equal" item and no substitution will be considered."

"55. Written Notice – Notice to any party which is in writing and which shall be considered delivered and the service thereof completed once posted by certified or registered mail to the party to whom the notice is sent at its last given address or delivered in person to said party or its authorized representative on the work."

SC-102. TERMINOLOGY. Add the following paragraphs G, H, and I.

"G. Imperative Mood. These specifications are written to the BIDDER before the award of the Contract and to the CONTRACTOR after award of the Contract. The sentences that direct the CONTRACTOR to perform work are mostly written as commands. For example, a requirement to provide cold-weather protection would be expressed as, 'Provide cold-weather protection for concrete,' rather than 'The Contractor shall provide cold-weather protection for concrete.' In the imperative mood, the subject "the Bidder" or "the Contractor" is understood.

"H. Engineer Interpretations. In order to avoid cumbersome and confusing repetition of expressions in these specifications, it is provided that whenever anything is, or is to be, done, if, as, or, when, or where 'demonstrated, contemplated, required, determined, directed, specified, authorized, ordered, given, designated, indicated, considered necessary, deemed necessary, permitted, reserved, suspended, established, approval, approved, disapproved, acceptable, unacceptable, suitable, satisfactory, unsatisfactory, sufficient, insufficient, rejected, or condemned,' it shall be understood as if the expression were followed by the words 'by the Engineer' or 'to the Engineer.'

"I. 'Shown.' When this term is used in the specifications, it means 'shown on the Drawings' unless stated otherwise."

SC-2. PRELIMINARY MATTERS.

SC-2.02. Copies of Documents. Delete the second sentence of paragraph 2.02.A and insert the following new sentence in its place:

> "Five (5) sets of contract drawings and specifications will be furnished the Contractor without charge. Additional sets will be furnished upon request at the cost of reproduction. The Contractor shall keep one (1) set of approved plans and specifications on the site of the work. This set shall be kept current by addition of all approved changes, addenda and amendments thereto. One set of as-built plans shall be returned to the Owner after the project is complete.
>
> The plans and specifications are intended to be complementary; but should any discrepancy appear or any misunderstanding arise as to the import of anything contained in either, the decision of the Owner shall be final and binding on the Contractor. The Owner may make any corrections of errors or omissions in the drawings and specifications when such corrections are necessary for the proper fulfillment of their intention as construed by the Owner.
>
> All work or materials shown on the plans and not mentioned in the specifications or any work specified and not shown on the plans, shall be furnished, performed and done by the Contractor as if the same were both mentioned in the specifications and shown on the plans.
>
> Should the Contractor in preparing its bid find anything necessary for the construction of the project that is not mentioned in the specifications or shown on the plans, or any discrepancy, it shall notify the Owner so that such items may be included. Should the Contractor fail to notify the Owner of such items, it will be assumed that its bid included everything necessary for the complete construction in the spirit and intent of the designs shown.
>
> In case of discrepancy, figure dimensions shall govern over scale dimensions, large-scale details shall govern over small-scale drawings, plans shall govern over specifications, detailed technical specifications shall govern over general specifications, and the more restrictive specifications shall prevail."

SC-2.03. Commencement of Contract Times; Notice to Proceed. Delete the paragraph and insert in its place:

> "A. The Contract Times will commence to run on the day indicated in the Notice to Proceed. The date for the Contract Times may be extended by mutual agreement between the OWNER and the CONTRACTOR."

SC-3. CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE. No modifications.

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

SC-4.02. Subsurface and Physical Conditions. Replace paragraph 4.02 with the following:

"A. Reports and Drawings:

"1. In preparation of the Contract Documents, the following reports of explorations and tests of subsurface conditions at the Site were used: Geotechnical Exploration Report, Sodium Hypochlorite Building, NKWD Dudley Complex" as investigated and written by Thelen Associates, Inc., Those reports of explorations and tests of subsurface conditions at or contiguous to the Site which ENGINEER has used in preparing the Contract Documents are not Contract Documents and are to be considered 'technical data.'

In preparation of the Contract Documents, the following drawings of physical conditions in or relating to the existing surface and subsurface structures (except underground facilities) which are at or contiguous to the Site of the Work were relied upon: Geotechnical Exploration Report, Sodium Hypochlorite Building, NKWD Dudley Complex" as investigated and written by Thelen Associates, Inc.

"2. CONTRACTOR may not rely upon or make any claim against OWNER or ENGINEER with respect to:

"a. 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

"b. Other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

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

SC-4.03. Differing Subsurface or Physical Conditions.

Replace paragraph 4.03.A with the following:

"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 nature as to require a change in the Contract Documents; or

"2. Differs materially from that shown or indicated in the Contract Documents; or

"3. Is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent on 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."

SC-4.04. Underground Facilities.

Add the following immediately after paragraph 4.04.A.2.

"4.04.A.3 Location of Subsurface Utilities.

"a. The location of subsurface utilities is shown on the plans from information furnished by the utility owners.

"b. The CONTRACTOR shall, no later than 2 working days, excluding Saturdays, Sundays, and legal holidays, prior to construction in the area of the subsurface utility, notify the subsurface utility Owner in writing, by telephone, or in person. The marking or locating shall be coordinated to stay approximately 2 days ahead of the planned construction.

"c. The CONTRACTOR shall alert immediately the occupants of nearby premises as to any emergency that it may create or discover at or near such premises.

"d. The CONTRACTOR shall have full responsibility for coordination of the work with owners of such underground facilities during construction, for the safety and protection thereof as provided in paragraph 6.13 and repairing any damage thereto resulting from the work, the cost of all of which will be considered as having been included in the Contract Price.

"4.04.A.4 Where existing utilities and structures are indicated as being in the line of the proposed improvement, the CONTRACTOR shall expose them sufficiently in advance of the construction operations to permit adjustments in line or grade, if required, to eliminate interferences.

"4.04.A.5 Existing pipes or conduits crossing a trench, or otherwise exposed, shall be adequately braced and supported to prevent movement during construction.

"4.04.A.6 Broken Utility Services.

"a. Utility services broken or damaged shall be repaired at once to avoid inconvenience to customers and utility owners.

"b. Temporary arrangements, as approved by the ENGINEER, may be used until any damaged items can be permanently repaired.

"c. All items damaged or destroyed by construction and subsequently repaired must be properly maintained by the CONTRACTOR.

"d. CONTRACTOR must work 24 hours a day until service is restored to a damaged utility.

"4.04.A.7 Existing Utility Relocation.

"a. Where it is necessary to relocate an existing utility or structure, the work shall be done in such manner as is necessary to restore it to a condition equal to that of the original utility or structure.

"b. No such relocation shall be done until approval is received from the authority responsible for the utility or structure being changed."

SC-4.06 Hazardous Environmental Conditions at Site.

Delete paragraph 4.06.A. in it entirety and substitute the following paragraph therefore:

A. The following reports and drawings related to Hazardous Environmental Conditions identified at the Site are known to Owner: None

Amend paragraph 4.06.B by adding the words “that is created by, or” immediately after the words “a Hazardous Environmental Condition” in the fourth line.

Amend paragraph 4.06.G by deleting all words following the words “Hazardous Environmental Condition” in the seventh line and substituting therefore the following words: “was created by Owner or by anyone for whom Owner is responsible, other than Contractor and all persons, subcontractors and entities for which Contractor is responsible.”

SC-5. BONDS AND INSURANCE.

SC-5.02. Licensed Sureties and Insurers. Add the following new sentence at the end of paragraph 5.02.A:

The surety company shall be rated “A” by AM BEST.

SC-5.03. Certificates of Insurance. Add the following new sentence at the end of paragraph 5.03.A:

Contractor shall deliver to Owner properly completed certificates of insurance prior to the start of any Work at the Site, on the forms included in the Contract Documents.

SC-5.04. Contractor’s Insurance.

Add the following new paragraphs immediately after paragraph 5.04.A.6:

7. Claims arising out of pollution and excluded from the Contractor’s general liability and comprehensive automobile liability policies. This insurance shall

be coordinated with the Contractor's general liability policy and shall provide bodily injury and property damage coverage similar to the Contractor's general liability policy. Coverage shall include contractual liability.

Add the following new paragraphs immediately after paragraph 5.04.B.6:

7. contain a cross liability or severability of interest clause or endorsement. Insurance covering the specified additional insureds shall be primary insurance, and all other insurance carried by the additional insureds shall be excess insurance;

8. with respect to workers' compensation and employers' liability, comprehensive automobile liability, commercial general liability, and umbrella liability insurance, and all other liability insurance specified herein to be provided by Contractor, Contractor shall require its insurance carriers to waive all rights of subrogation against Owner, Engineer, and their respective officers, directors, partners, employees, and agents.

Add the following new paragraphs immediately after paragraph 5.04.B:

C. The insurance required by paragraph 5.04 shall include coverage as necessary for the benefits provided under the United States Longshoremen's and Harbor Workers' Act and the Jones Act. This policy shall include an "all states" endorsement.

D. The limits of liability for the insurance required by paragraph 5.04 of the General Conditions shall provide coverage for not less than the following amounts but shall provide coverage in greater amounts where required by Laws and Regulations. This coverage may be primary or a combination of primary and umbrella excess liability.

1. Workers' Compensation, and related coverage under paragraphs 5.04.A.1 and 5.04.A.2 of the General Conditions:

a.	State	Statutory
b.	Applicable Federal (e.g., Longshoreman's)	Statutory
b.	Employer's Liability	$1,000,000 each occurrence

2. Commercial General Liability under paragraphs 5.04.A.3 through 5.04.A.6 of the General Conditions shall be occurrence type, written in comprehensive form, and shall protect Contractor, Owner, and Engineer as additional insureds, against claims arising from injuries, sickness, disease, or death of any person or damage to property arising out of performance of the Work. The policy shall also include a per project aggregate limit endorsement, personal injury liability coverage, contractual liability coverage for blasting, explosion, collapse of buildings, and damage to underground property.

a.	General Aggregate	$1,000,000

b. Products – Completed Operations Aggregate $1,000,000

c. Personal and Advertising Injury $1,000,000

d. Each Occurrence (Bodily Injury and Property Damage) $1,000,000

e. Property Damage liability insurance will provide Explosion, Collapse and Underground coverage's where applicable.

3. Automobile Liability under paragraph 5.04.A.6 of the General Conditions shall be occurrence type, written in comprehensive form, and shall protect Contractor, Owner, and Engineer as additional insureds, against all claims for injuries to members of the public and damage to property of others arising from the use of motor vehicles, either on or off the project site whether they are owned, nonowned, or hired. The liability limit shall be not less than:

a. Bodily Injury
Each Person $1,000,000
Each Accident $1,000,000

b. Property Damage
Each Accident $1,000,000

c. Combined Single Limit $1,000,000

4. Umbrella Liability Insurance shall protect Contractor, Owner, and Engineer as additional insureds, against claims in excess of the limits provided under workers' compensation and employers' liability, comprehensive automobile liability, and commercial general liability policies. The umbrella policy shall follow the forms of the primary insurance, including the application of the primary limits. The liability limits shall be not less than:

Bodily injury and Property damage: $4,000,000 combined single limit for each occurrence

$4,000,000 general aggregate

SC-5.05. Owner's Liability Insurance. Delete paragraph 5.05 in its entirety and insert the following new paragraph in its place:

5.05. *Owner's Liability Insurance*. This insurance shall be obtained by Contractor and issued in the name of Owner, and shall protect and defend Owner against claims arising as a result of the operations of Contractor or Contractor's Subcontractors. The liability limits shall be not less than:

a. Bodily Injury
Each Occurrence $1,000,000
General Aggregate $1,000,000

b. Property Damage

Each Occurrence	$1,000,000
General Aggregate	$1,000,000

SC-5.06. Property Insurance. Delete paragraph 5.06 in its entirety and insert the following new paragraphs in their place:

5.06. *Property Insurance*

A. Contractor shall purchase and maintain property insurance coverage upon the Work at the Site in the amount of the full replacement cost thereof. 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, 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, flood, damage caused by frost and freezing, and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;

3. 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 accepted by Owner;

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

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. Contractor shall be responsible for any deductible or self-insured retention.

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

SC-6. CONTRACTOR'S RESPONSIBILITIES.

SC-6.02. Labor; Working Hours. Add the following new paragraphs immediately after paragraph 6.02.B:

C. No Work shall be done between 6:00 p.m. and 7:00 a.m. without permission of Owner. However, emergency work may be done without prior permission.

D. Night Work may be undertaken as a regular procedure with the permission of Owner; such permission, however, may be revoked at any time by Owner if Contractor fails to maintain adequate equipment and supervision for the proper prosecution and control of the Work at night.

SC-6.05. Substitutes and "Or-Equals'. Add the following new paragraph after paragraph 6.05.A.2.d:

e. "If a proposed substitute item is accepted, all incidental costs associated with the use of the substitute including, but not limited to, redesign, claims of other Contractors, changes to electrical supply equipment, additional equipment or material required for the installation, etc., shall be at the expense of the Contractor proposing the substitute unless otherwise agreed to by the Owner."

SC-6.06. Concerning Subcontractors, Suppliers, and Others. Delete paragraph 6.06.B in its entirety and insert the following new paragraph in its place:

B. Contractor must identify to Owner the following Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner by the date indicated: (Fill in or write Not applicable. Must be consistent with those listed on the Bid Form [i.e. Electrical and Instrumentation/SCADA Contractors, Major Equipment Manufacturers])._____
_____,
Date:_____. If Contractor has submitted a list thereof in accordance with these 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 without an increase in the Contract Price. 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.

SC-6.08. Permits. Add the following new paragraph immediately after paragraph 6.08.A:

B. Owner will obtain and pay for the following permits: Road & Highway Encroachment Permits, Kentucky Division of Water, and Stream Crossing Permits.

SC-6.09. Laws and Regulations. Add the following new paragraph immediately after paragraph 6.09.C:

D. Employment requirements shall be as specified herein and in the attachments at the end of the Supplementary Conditions.

SC-6.10. Taxes. Add the following new paragraph immediately after Paragraph 6.10.A of the General Conditions:

B. Portions of this project may be exempt from taxes. It is the Contractor's responsibility to determine any applicable exemptions.

SC-6.19. Contractor's General Warranty and Guarantee. Delete paragraph 6.19.C.7 and substitute the following new paragraph therefore:

7. any correction of defective Work by Owner; or

Add the following new paragraph immediately after paragraph 6.19.C.7:

8. any expiration of a correction period.

SC-7. OTHER WORK. No modifications.

SC-8. OWNER'S RESPONSIBILITIES. No modifications.

SC-9. ENGINEER'S STATUS DURING CONSTRUCTION.

SC-9.02. Visits to Site. Delete paragraph 9.02.A in its entirety and insert the following new paragraph in its place:

A. Engineer may make visits to the Site as Owner 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, at the request and benefit of Owner, may 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 advise Owner of the progress of the Work and will endeavor to guard Owner against defective Work.

SC-10. CHANGES IN THE WORK. No Modifications.

SC-11. COST OF THE WORK; CASH ALLOWANCES; UNIT PRICE WORK. No modifications.

SC-12. CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES.

SC-12.03. Delays Beyond Contractor's Control. Insert the following new paragraph 12.03.F immediately after paragraph 12.03.E:

F. 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 (including acceleration costs) arising out of or resulting from any delay.

SC-12.04. Delay Damages. Add the following new paragraph after paragraph 12.03.

A. Except as set forth in paragraph 3.3 of the Agreement, 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 (including acceleration costs) arising out of or resulting from any delay.

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

SC-13.02. Access to Work. Add the following new paragraph immediately after paragraph 13.02.A:

B. Authorized representatives of the U.S. Environmental Protection Agency and the Kentucky Division of Water shall have access to the Work whenever it is in preparation or progress. Contractor shall provide proper facilities for such access and inspection.

SC-13.07. Correction Period. Add the following new paragraph after paragraph 13.07.E:

F. Nothing in Article 13 concerning the correction period shall establish a period of limitation with respect to any other obligation which Contractor has under the Contract Documents. The establishment of time periods relates only to the specific obligations of Contractor to correct the Work, and has no relationship to the time within which Contractor's obligations under the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish Contractor's liability with respect to Contractor's obligations other than to specifically correct the Work.

SC-14. PAYMENTS TO CONTRACTOR AND COMPLETION.

SC-14.02. Applications for Payments. Add the following new paragraphs immediately after paragraph 14.02.A.3:

4. Contractor's Applications for Payment shall be accompanied by the documentation specified herein.

5. Payments for stored materials and equipment shall be based only upon the actual cost to Contractor of the materials and equipment and shall not include any overhead or profit to Contractor. Partial payments will not be made for undelivered materials or equipment.

6. During the progress of the Work, each Application for Payment shall be accompanied by Contractor's updated schedule of operations, or progress report, with such shop drawings schedules, procurement schedules, value of material on hand included in application, and other data specified in Contract Documents or reasonably required by Owner.

Delete paragraphs 14.02.C in its entirety and insert the following new paragraphs in its place:

C. *Payment Becomes Due*

1. Twenty-five 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.

SC-14.04. Substantial Completion. Add the following new paragraphs following paragraph 14.04.A:

To be considered substantially complete, the following portions of the Work must be operational and ready for Owner's continuous use as intended: New building completed and being used to store sodium hypochlorite in chemical tanks. The chemical feed pumps shall be capable of delivering the required dose to the point of application under the automatic SCADA controls from the Fort Thomas WTP, Taylor Mill WTP, and/or Memorial WTP. Additionally, submittal of approved O&M manuals and completion of vendor training must be completed for the project to be considered substantially complete.

Portions of the Work not essential to operation, which can be completed without interruption of the Owner's operation, may be completed after the Work is accepted as substantially complete, and may include the following items: Fencing, seeding and sodding, and painting.

SC-14.07. Final Application for Payment. Add the following new sentence immediately after the last sentence of paragraph 14.07.A.2.b.:

Consent of the surety, signed by an agent, must be accompanied by a certified copy of such agent's authority to act for the surety. The Contractor shall be responsible for providing all of the documents identified in this paragraph.

SC-15. SUSPENSION OF WORK AND TERMINATION.

SC-15.01 Owner may suspend Work. Delete the word "shall" in the fifth line of paragraph 15.01.A and substitute the word "may" therefore.

SC-16. DISPUTE RESOLUTION.

Delete Article 16 in its entirety and insert the following new article in its place:

ARTICLE 16 - DISPUTES.

Arbitration will not be acceptable as a means for settling claims, disputes, and other matters.

SC-17. MISCELLANEOUS.

SC-17.04. Survival of Obligations. Add the following new paragraph immediately after paragraph 17.04.A:

B. Contractor shall obtain from all Suppliers and manufacturers any and all warranties and guarantees of such Suppliers and manufacturers, whether or not specifically required by the Specifications, and shall assign such warranties and guarantees to Owner. With respect thereto, Contractor shall render reasonable assistance to Owner when requested, in order to enable Owner to enforce such warranties and guarantees. The assignment of any warranties or guarantees shall not affect the Correction Period or any other provisions of these Contract Documents.

End of Section

GRW SUPPLEMENTAL GENERAL CONDITIONS TO EJCDC GENERAL CONDITIONS

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GRW SUPPLEMENTAL GENERAL CONDITIONS TO EJCDC GENERAL CONDITIONS

These Supplemental General Conditions amend or supplement the General Conditions of the Construction Contract and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in these Supplemental General Conditions which are defined in the Standard General Conditions of the Construction Contract have the meanings assigned to them in the General Conditions.

SGC-3.01

Add the following new paragraph immediately after Paragraph 3.01C:

If there is any conflict between the provisions of the Contract Documents and any referenced provisions within the Contract Specifications, the language of the Contract Documents will take precedence over that of any standard specification, manual, or code.

SGC-4.04

Add the following new paragraphs immediately after Paragraph 4.04 B.2:

Special precautions shall be taken by the Contractor to avoid damage to existing overhead and underground utilities owned and operated by the Owner or by public or private utility companies.

The available information concerning the location of existing underground utilities is shown on the Drawings. While it is believed that the locations shown are reasonably correct, neither the Engineer nor the Owner can guarantee the accuracy or adequacy of this information.

Before proceeding with the work, the Contractor shall confer with all public or private companies, agencies or departments that own and operate utilities in the vicinity of the construction work. The purpose of the conference, or conferences, shall be to notify said companies, agencies or departments of the proposed construction schedule, verify the location of, and possible interference with, the existing utilities that are shown on the Drawings, arrange for necessary suspension of service, and make arrangements to locate and avoid interference with all utilities (including house connections) that are not shown on the Drawings. The Engineer and Owner have no objection to the Contractor arranging for the said utility companies, agencies, or departments to locate and uncover their own utilities; however, the Contractor shall bear the entire responsibility and cost of locating and avoiding, or repairing damage to said existing utilities.

The Contractor shall locate all unknown metallic hazards, namely buried pipe, metals, etc., by using a pipe locator. The pipe locator shall immediately precede the trench ditching and all hazards located shall be marked in such manner as to notify the machine operator of such hazard.

Where existing utilities or appurtenant structures either underground or above ground, are encountered, they shall not be displaced or molested unless necessary, and in such case shall be replaced in as good or better condition than found as quickly as possible. Relocation and/or replacement of all utilities and appurtenant structures to accommodate the construction work shall be at the Contractor's expense, unless such relocation and/or replacement is by statute agreement the responsibility of the owner of the utility.

SGC-5.01

Add the following new paragraph immediately after Paragraph 5.01C:

The Performance Bond shall remain in full force and effect throughout the Guaranty period referred to in SGC 6.03. All warranties and guarantees remaining in effect at and beyond the Guaranty expiration date shall be relinquished and transferred to the Owner. Copies of such warranty/guaranty shall be submitted to the Engineer prior to date of the start of the Guaranty period.

SGC-6.02

Add the following new paragraphs immediately after Paragraph 6.02A:

The Contractor shall employ workmen skilled in their various duties and shall remove from the project, at the request of the Engineer, any person employed in, about, or upon the work, who misconducts himself or is incompetent or negligent in the performance of the duties assigned to him.

No person under the age of eighteen (18) years and no convict labor shall be employed to perform any work under this Contract. No person whose age or physical condition is such as to make its employment dangerous to its health or safety or to the health or safety of others shall be employed to perform any work under this Contract, provided that this shall not operate against the employment of physically handicapped persons, otherwise employable, where such persons may be safely assigned to work which they can ably perform. There shall be no discrimination because of race, creed, color or political affiliation in the employment of persons for work under this Contract.

With respect to additional skilled, semi-skilled and unskilled workers employed to perform work on the project, preference in employment shall be given first to persons who reside in the city in which the work is to be performed, and second to persons residing in the county in which the work is to be performed.

SGC-6.03

Add the following new paragraph immediately after Paragraph 6.03B:

The Contractor agrees that it will obtain from the manufacturers of equipment and materials furnished under this Contract guarantees against defective materials and workmanship, and if those guarantees furnished by the manufacturer do not extend for the term of one (1) year from and after the date upon which the final estimate of the Engineer is formally approved by the Owner or other established date as set forth herein (such as the substantial completion date), it shall make the necessary arrangements and assume all cost for extending this guarantee for the required period.

SGC-6.17

Delete Paragraph 6.17 D.3 in its entirety and insert the following in its place.

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, or has issued a Change Order that authorizes the deviation. CONTRACTOR shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the ENGINEER'S approval thereof.

Add the following new paragraph immediately after Paragraph 6.17 D.3:

ENGINEER'S review of submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment of systems, all of which remain the responsibility of the Contractor as required by the Contract Documents.

SGC-10.03

Add the following new paragraph immediately after Paragraph 10.03:

B. A sample Change Order form is included as Section 00 63 63.

SGC-13.06

Add a new paragraph immediately after Paragraph 13.06 of the General Conditions which is to read as follows:

When the repairs or replacements involve one or more items of installed equipment, Contractor shall provide the services of qualified factory-trained servicemen in the employ of the equipment manufacturers to perform or supervise the repairs or replacements.

SGC-13.09

Add the following new paragraph immediately after Paragraph 13.09D:

When the Engineer or the Owner deems it necessary, and so orders, such replacements or repairs under this section shall be undertaken by the Contractor within twenty-four (24) hours after service of notice. If the Contractor unnecessarily delays or fails to make the ordered replacements or repairs within the time specified, or if any replacements or repairs within the time specified, or if any replacements or repairs are of such nature as not to admit of the delay incident to the service of a notice, then the Owner shall have the right to make such replacements or repairs and the expense thereof shall be paid by the Contractor or deducted from any moneys due to Contractor.

SGC-14.01

Add the following to Paragraph 14.01:

The Application for Payment form shall be exactly as shown in Section 00 62 76.

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PREVAILING WAGE RATE REQUIREMENTS AND LABOR PROVISIONS - KENTUCKY

PART 1 - GENERAL

1.1 HOURS OF WORK

A. The Contractor shall comply in every respect to all provisions of the Kentucky Revised Statutes 337.505 to 337.550.

B. Current Prevailing Wage Rates are attached as part of this section. Any revised Wage Rates will be issued by addendum.

C. Contractor shall be aware that there may be a Federal Prevailing Wage Rate Schedule and a State Prevailing Wage Rate schedule included in this contract. Contractor is responsible for determining and using the higher wage rate in each individual wage category that is used under this contract.

D. Contractor is responsible for determining the appropriate staffing necessary to perform the contract work. Contractors are also responsible for complying with the minimum wage and benefits requirements for each classification performing work on the contract. If a classification considered necessary by the contractor for performance of the work is not listed on the applicable wage determination, the Contractor must initiate a request for approval of an additional classification along with the proposed wage and benefit rates for that classification.

E. Hours of work shall be as set out in KRS 337.550; that is, not more than eight (8) hours in one calendar day, nor more than forty (40) hours in one week, except in case of emergency caused by fire, flood or damage to life or property.

F. The provisions included under KRS 337.540 concerning a 10-hour workday may be allowed if Owner is in agreement.

G. Any laborer, workman, mechanic, helper, assistant or apprentice working in excess of eight (8) hours per day or forty (40) hours in one week except in case of emergency, shall be paid not less than 1-1/2 times the base rate.

1.2 OVERTIME WORK

A. Any overtime work (greater than 40 hours in one week) shall require the Contractor to reimburse the Owner for additional resident inspection costs at an hourly rate of $65.00 per hour.

1.3 PREVAILING WAGE REQUIREMENT

A. In accordance with Kentucky Revised Statutes 337.510, Kentucky State Prevailing Wage Rates shall be in effect for all contracts with an estimated value in excess of $250,000, regardless of the actual bid or contract amount.

B. Required Wage Rates are included in these specifications.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 004343

STATE WAGE RATES

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Steven L. Beshear
Governor

KENTUCKY LABOR CABINET
DEPARTMENT OF WORKPLACE STANDARDS
DIVISION OF EMPLOYMENT STANDARDS,
APPRENTICESHIP & MEDIATION
1047 US Hwy 127 S - Suite 4
Frankfort, Kentucky 40601
Phone: (502) 564-3534
Fax (502) 696-1897
www.labor.ky.gov

Larry Roberts
Secretary

Anthony Russell
Commissioner

March 24, 2015

Adalyn Haney
GRW Inc.
9710 Bunsen Parkway
Louisville KY 40299

Re: NK Water District, Dudley Complex Sodium Hypochlorite Building

Advertising Date as Shown on Notification: April 2, 2015

Dear Adalyn Haney:

This office is in receipt of your written notification on the above project as required by KRS 337.510 (1).

I am enclosing a copy of the current prevailing wage determination number CR 2-013, dated December 22, 2014 for KENTON County. This schedule of wages shall be attached to and made a part of the specifications for the work, printed on the bidding blanks, and made a part of the contract for the construction of the public works between the public authority and the successful bidder or bidders.

The determination number assigned to this project is based upon the advertising date contained in your notification. There may be modifications to this wage determination prior to the advertising date indicated. In addition, if the contract is not awarded within 90 days of this advertising date or if the advertising date is modified, a different set of prevailing rates of wages may be applicable. It will be the responsibility of the public authority to contact this office and verify the correct schedule of the prevailing rates of wages for use on the project. Your project number is as follows: 059-H-00621-14-2, Heavy/Highway

Sincerely,

Anthony Russell
Commissioner

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KENTUCKY LABOR CABINET
PREVAILING WAGE DETERMINATION
CURRENT REVISION
LOCALITY NO. 023

KENTON COUNTY

Determination No. CR 2-023 2014

Date of Determination: December 22, 2014

PROJECT NO. 059-H-00621-14-2

_____ **BLDG** _____ **HH**

This schedule of the prevailing rate of wages for Kenton County has been determined in accordance with the provisions of KRS 337.505 to 337.550. This determination shall be referred to as Prevailing Wage Determination No. CR 2-023 2014.

Apprentices shall be permitted to work as such subject to Administrative Regulations 803 KAR 1:010. Copies of these regulations will be furnished upon request to any interested person.

Overtime is to be computed at not less than one and one-half (1 1/2) times the indicated BASE RATE for all hours worked in excess of eight (8) per day, and/or in excess of forty (40) per week. However, KRS 337.540 permits an employee and employer to agree, in writing, that the employee will be compensated at a straight time base rate for hours worked in excess of eight (8) hours in any one calendar day, but not more than ten (10) hours worked in any one calendar day, if such written agreement is prior to the over eight (8) hours in a calendar day actually being worked, or where provided for in a collective bargaining agreement. The fringe benefit rate is to be paid for each hour worked at a straight time rate for all hours worked.

Fringe benefit amounts are applicable for all hours worked except when otherwise noted. Welders will receive rate for craft in which welding is incidental.

NOTE: The type of construction shall be determined by applying the following definitions:

BUILDING CONSTRUCTION
Building construction is the construction of sheltered enclosures with walk-in access for the purpose of housing persons, machinery, equipment, or supplies. It includes all construction of such structures, the installation of utilities and the installation of equipment, both above and below grade level, as well as incidental grading, utilities and paving.

HIGHWAY CONSTRUCTION
Highway construction includes the construction, alteration or repair of roads, streets, highways, runways, taxiways, alleys, trails, paths, parking areas, and other similar projects not incidental to building or heavy construction. It includes all incidental construction in conjunction with the highway construction project.

HEAVY CONSTRUCTION
Heavy projects are those projects that are not properly classified as either "building" or "highway". For example, dredging projects, water and sewer line projects, dams, flood control projects, sewage treatment plants and facilities, and water treatment plants and facilities are considered heavy.

Anthony Russell, Commissioner
Department of Workplace Standards
Kentucky Labor Cabinet

Determination No. CR 2-023 2014
December 22, 2014

ASBESTOS/INSULATION WORKERS:

(Including duct (hot/cold), Pipe Insulator, pipe wrapping):		BASE RATE	$29.05
		FRINGE BENEFITS	14.27

Hazardous Material Handlers: (Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging & disposing of all insulation materials, whether they contain asbestos or nor, from mechanical systems):

		BASE RATE	$23.60
		FRINGE BENEFITS	9.80

BOILERMAKERS:		BASE RATE	$35.79
		FRINGE BENEFITS	16.71

BRICKLAYERS:

Bricklayers:	BUILDING	BASE RATE	$21.86
		FRINGE BENEFITS	4.75
Tile Setters:	BUILDING	BASE RATE	$25.54
		FRINGE BENEFITS	11.64
Tile Finishers:	BUILDING	BASE RATE	$22.90
		FRINGE BENEFITS	10.87
Bricklayer:	HEAVY HIGHWAY	BASE RATE	$26.50
		FRINGE BENEFITS	11.17

CARPENTERS:

Carpenters: (Including drywall hanging & metal stud installation):

	BUILDING	BASE RATE	$21.58
		FRINGE BENEFITS	13.41
Carpenters & Piledrivermen:	HEAVY & HIGHWAY	BASE RATE	$27.05
		FRINGE BENEFITS	9.69
Divers:	HEAVY & HIGHWAY	BASE RATE	$40.58
		FRINGE BENEFITS	9.69

CEMENT MASON / CONCRETE FINISHERS:

	BUILDING	BASE RATE	$22.00
		FRINGE BENEFITS	12.55
	HEAVY & HIGHWAY	BASE RATE	$25.75
		FRINGE BENEFITS	8.60

ELECTRICIANS:

Electricians:		BASE RATE	$26.74
		FRINGE BENEFITS	16.45

ELECTRICIAN/LINE CONSTRUCTION:

Linemen:	BUILDING	BASE RATE	$30.50
		FRINGE BENEFITS	11.15
Equipment Operator:	BUILDING	BASE RATE	$27.45
		FRINGE BENEFITS	10.51

ELECTRICIAN/LINE CONSTRUCTION: CONTINUED

Groundmen:	BUILDING	BASE RATE	$19.83
		FRINGE BENEFITS	8.92
SOUND & COMMUNICATION TECHNICIAN**:**		BASE RATE	$21.55
		FRINGE BENEFITS	8.46
ELEVATOR MECHANICS:		BASE RATE	$37.47
		FRINGE BENEFITS	20.035
GLAZIERS:		BASE RATE	$15.45
		FRINGE BENEFITS	0.00
IRONWORKERS:			
Structural & Ornamental:		BASE RATE	$25.00
		FRINGE BENEFITS	18.40
Fence Erector:		BASE RATE	$22.70
		FRINGE BENEFITS	18.40
REINFORCING:		BASE RATE	$26.25
		FRINGE BENEFITS	18.45
LABORERS / BUILDING:			
Landscape Laborer and Mason Tender-Brick (Hod):			
	BUILDING	BASE RATE	$22.90
		FRINGE BENEFITS	9.20
Pipelayer and Screw Operator:	BUILDING	BASE RATE	$23.00
		FRING BENEFITS	9.20
Grade Checker:	BUILDING	BASE RATE	$22.90
		FRINGE BENEFITS	9.20
LABORER	COMMON OR GENERAL	BASE RATE	$17.17
		FRINGE BENEFITS	4.58
LABORER	MASON TENDER-BRICK	BASE RATE	$14.75
		FRINGE BENEFITS	2.04
Mason Tender-Cement/Concrete:		BASE RATE	$14.45
		FRINGE BENEFITS	0.00

LABORER / HEAVY HIGHWAY:

GROUP 1: Asphalt Laborer, Carpenter Tender, Concrete Curing applicator, Dump Man (Batch Truck), Guardrail and Fence Installer, Joint Setter, Laborer (Construction), Landscape Laborer, Mesh Handlers & Placer, Right-of-way Laborer, Riprap Laborer & Grouter, Scaffold Erector, Seal Coating, Surface Treatment or Road Mix Laborer, Sign Installer, Slurry Seal, Utility Man, Bridge Man, Handyman, waterproofing Laborer, Flagperson, Hazardous Waste (Level D), Diver Tender, Zone Person & Traffic Control:

HEAVY & HIGHWAY	BASE RATE	$27.72
	FRINGE BENEFITS	9.80

GROUP 2: Skid Steer, Asphalt Raker, Concrete Puddler, Kettle Man (Pipeline), Machine Driven Tools (Gas, Electric, Air), Mason Tender, Brick Paver, Mortar Mixer, Power Buggy or Power Wheelbarrow, Sheeting & Shoring Man, Surface Grinder Man, Plastic Fusing Machine Operator, Pug Mill Operator, & Vacuum Devices (wet or dry), Rodding Machine Operator, Diver, Screwman or Paver, Screed Person, Water Blast, Hand Held Wand, Pumps 4" & Under (Gas, Air or Electric) & Hazardous Waste (Level C), Air Track and Wagon Drill, Bottom Person, Cofferdam (below 25 ft. deep), Concrete Saw Person, Cutting with Burning Torch, Form Setter, Hand Spiker (Railroad), Pipelayer, tunnel Laborer (without air) & Caisson, Underground Person (working in Sewer and Waterline, Cleaning, Repairing & Reconditioning), Sandblaster Nozzle Person, & Hazardous Waste (Level B):

HEAVY & HIGHWAY	BASE RATE	$27.89
	FRINGE BENEFITS	9.80

GROUP 3: Blaster, Mucker, Powder Person, Top Lander, Wrencher (Mechanical Joints & Utility Pipeline), Yarner, Hazardous Waste (Level A), Concrete Specialist, Concrete Crew in Tunnels (With Air-pressurized - $1.00 premium), Curb Setter & Cutter, Grade Checker, Utility Pipeline Tapper, Waterline, and Caulker:

HEAVY & HIGHWAY	BASE RATE	$28.22
	FRINGE BENEFITS	9.80

GROUP 4: Miner (With Air-pressurized - $1.00 premium), & Gunnite Nozzle Person:

HEAVY & HIGHWAY	BASE RATE	$28.67
	FRINGE BENEFITS	9.80

Signal Person will receive the rate equal to the rate paid the laborer classification for which he or she is signaling

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MILLWRIGHTS:	BASE RATE	$27.55
	FRINGE BENEFITS	15.39

OPERATING ENGINEERS / BUILDING:

GROUP 1: Boom & Jib 250' over:

BUILDING	BASE RATE	$33.49
	FRINGE BENEFITS	13.90

GROUP 2: Boom & Jib Over 180' through 249:

BUILDING	BASE RATE	$33.24
	FRINGE BENEFITS	13.90

GROUP 3: Boom & Jib 150' through 180':

BUILDING	BASE RATE	$32.74
	FRINGE BENEFITS	13.90

GROUP 4: Master Mechanic:

BUILDING	BASE RATE	$32.49
	FRINGE BENEFITS	13.90

OPERATING ENGINEERS / BUILDING: CONTINUED

GROUP 5: Crane (compact track or rubber over 4,000 lbs capacity, self erecting, stationary, track or truck (all configurations)), elevating grader, forklift (rough terrain with winch/hoist, backhoe, backhoe track, trackhoe, hoist (2 or more drums), horizontal directional drill, rotary drill, slip form paver:

	BUILDING	BASE RATE	$32.24
		FRINGE BENEFITS	13.90

GROUP 6: Asphalt Paver; Bobcat-type and/or Skid Steer Loader with Hoe Attachment Greater than 7,000 lbs.; Bulldozer; Endloader; Power Grader; Power Scraper:

	BUILDING	BASE RATE	$32.12
		FRINGE BENEFITS	13.90

GROUP 7: Forklift (except masonry), highway drills-all types, hoist (1 drum):

	BUILDING	BASE RATE	$31.08
		FRINGE BENEFITS	13.90

GROUP 8: Roller (except asphalt), self propelled sub grader, tractor (pulling sheep foot roller or grader):

	BUILDING	BASE RATE	$29.90
		FRINGE BENEFITS	13.90

GROUP 9: Allen Screed Paver(concrete); crane compact, track or rubber under 4,000 lbs, masonry forklift, oiler:

	BUILDING	BASE RATE	$24.44
		FRINGE BENEFITS	13.90

OPERATOR	BOBCAT/SKID LOADER	BASE RATE	$20.77
		FRINGE BENEFITS	5.38
OPERATOR	COMPACTOR	BASE RATE	$24.53
		FRINGE BENEFITS	0.00
OPERATOR	EXCAVATOR	BASE RATE	$19.18
		FRINGE BENEFITS	5.16
OPERATOR	HIGHLIFT	BASE RATE	$25.00
		FRINGE BENEFITS	0.00

OPERATING ENGINEERS / HEAVY HIGHWAY:

Master Mechanic & Boom from 150-180:

	HEAVY & HIGHWAY	BASE RATE	$32.69
		FRINGE BENEFITS	13.90
Boom from 180 and over:	HEAVY & HIGHWAY	BASE RATE	$32.94
		FRINGE BENEFITS	13.90

OPERATING ENGINEERS / HEAVY HIGHWAY: CONTINUED

GROUP 1: Air Compressor on Steel Erection; Barrier Moving Machine; Boiler Operator on Compressor or Generator when mounted on a Rig; Cableway; Combination Concrete Mixer & Tower; Concrete Plant (over 4 yd. Capacity); Concrete Pump; Crane (All Types, Including Boom Truck, Cherry Picker); Crane-Compact, Track or Rubber over 4,000 lbs. capacity; Cranes-Self Erecting, Stationary, Track or Truck (All Configurations); Derrick; Dragline; Dredge (Dipper, Clam or Suction); Elevating Grader or Euclid Loader; Floating Equipment (All Types); Gradual; Helicopter Crew (Operator-Hoist or Winch); Hoe (all types); Hoisting Engine on Shaft or Tunnel Work; Horizontal Directional Drill (over 500,000 ft. lbs. thrust); Hydraulic Gantry (Lifting System); Industrial-Type Tractor; Jet Engine Dryer (D8 or D9) Diesel Tractor; Locomotive (Standard Gauge); Maintenance Operator Class A; Mixer, Paving (Single or Double Drum); Mucking Machine; Multiple Scraper; Piledriving Machine (All Types); Power Shovel; Prentice Loader; Quad 9 (Double Pusher); Rail Tamper (with auto lifting & aligning device); Refrigerating Machine (Freezer Operation); Rotary Drill, on Caisson work; Rough Terrain Fork Lift with Winch/Hoist; Side-Boom; Slip-Form Paver; Tower Derrick; Tree Shredder; Trench Machine (Over 24" wide); Truck Mounted Concrete Pump; Tug Boat; Tunnel Machine and/or Mining Machine; & Wheel Excavator:

HEAVY & HIGHWAY	BASE RATE	$32.44
	FRINGE BENEFITS	13.90

GROUP 2: Asphalt Paver; Automatic Subgrader Machine, Self-Propelled (CMI Type); Bobcat Type and/or Skid Steer Loader with Hoe Attachment Greater than 7,000 lbs.; Boring Machine More than 48"; Bulldozer; Endloader; Hydro Milling Machine; Kolman-type Loader (production type-Dirt); Lead Greaseman; Lighting & Traffic Signal Installation Equipment (includes all groups or classifications); Material Transfer Equipment (Shuttle Buggy) Asphalt; Pettibone-Rail Equipment; Power Grader; Power Scraper; Push Cat; Rotomill (all), Grinders & Planers of All types; Trench Machine (24" wide & under); & Vermeer type Concrete Saw:

HEAVY & HIGHWAY	BASE RATE	$32.32
	FRINGE BENEFITS	13.90

GROUP 3: A-Frame; Air Compressor on Tunnel Work (low pressure); Asphalt Plant Engineer; Bobcat-type and/or Skid Steer Loader with or without Attachments; Highway Drills (all types); Locomotive (narrow gauge); Material Hoist/Elevator; Mixer, Concrete (more than one bag capacity); Mixer, one bag capacity (Side Loader); Power Boiler (Over 15 lbs. Pressure) Pump Operator installing & operating Well Points; Pump (4" & over discharge); Roller, Asphalt; Rotovator (lime soil stabilizer); Switch & Tie Tampers (without lifting & aligning device); Utility Operator (Small equipment); & Welding Machines:

HEAVY & HIGHWAY	BASE RATE	$31.28
	FRINGE BENEFITS	13.90

GROUP 4: Backfiller; Ballast Re-locator; Bars, Joint & Mesh Installing Machine; Batch Plant; Boring Machine Operator (48" or less); Bull Floats; Burlap & Curing Machine; Concrete Plant (capacity 4 yd. & under); Concrete Saw (Multiple); Conveyor (Highway); Crusher; Deckhand; Farm-type Tractor with attachments (highway) except Masonry); Finishing Machine; Fireperson, Floating Equipment (all types); Fork Lift (highway); Form Trencher; Hydro Hammer; Hydro Seeder; Pavement Breaker; Plant Mixer; Post Driver; Post Hole Digger (Power Auger); Power Brush Burner; Power Form Handling Equipment; Road Widening Trencher; Roller (Brick, Grade & Macadam); Self-Propelled Power Spreader; Self-Propelled Power Subgrader; Steam Fireperson; Tractor (Pulling Sheepfoot, Roller or Grader); & Vibratory Compactor with Integral Power:

HEAVY & HIGHWAY	BASE RATE	$30.10
	FRINGE BENEFITS	13.90

GROUP 5: Compressor (Portable, Sewer, Heavy & Highway); Drum Fireperson (Asphalt); Generator; Inboard-Outboard Motor Boat Launch; Masonry Fork Lift; Oil Heater (asphalt plant); Oiler; Power Driven Heater; Power Sweeper & Scrubber; Pump (under 4" discharge); Signalperson; Tire Repairperson; & VAC/ALLS:

HEAVY & HIGHWAY	BASE RATE	$24.64
	FRINGE BENEFITS	13.90

PAINTERS / BUILDING:			
Brush & Roller Only:	BUILDING	BASE RATE	$21.30
		FRINGE BENEFITS	3.80
Spray Only:	BUILDING	BASE RATE	$23.89
		FRINGE BENEFITS	8.71
Sign Painter & Erector:	BUILDING	BASE RATE	$20.23
		FRINGE BENEFITS	3.25
PAINTERS / HEAVY & HIGHWAY			
Bridge/Equipment Tender and/or Containment Builder:			
	HEAVY & HIGHWAY	BASE RATE	$20.73
		FRINGE BENEFITS	8.71
Brush & Roller:	HEAVY & HIGHWAY	BASE RATE	$23.39
		FRINGE BENEFITS	8.71
Spray:	HEAVY & HIGHWAY	BASE RATE	$23.89
		FRINGE BENEFITS	8.71
Sandblasting & Water Blasting:	HEAVY & HIGHWAY	BASE RATE	$24.14
		FRINGE BENEFITS	8.71
Bridge:	HEAVY & HIGHWAY	BASE RATE	$24.39
		FRINGE BENEFITS	8.71
PIPEFITTERS & PLUMBERS:			
(Including HVAC Pipe Installation & HVAC System Installation):		BASE RATE	$29.80
		FRINGE BENEFITS	17.79
PLASTERERS:	BUILDING	BASE RATE	$22.00
		FRINGE BENEFITS	10.10
ROOFERS (excluding metal roofs):			
(Including built up roof, modified bitumen roof, rubber roof, shake & shingle roof & single ply roof:			
		BASE RATE	$26.31
		FRINGE BENEFITS	12.30
SHEETMETAL WORKERS (including metal roofs):			
(including HVAC duct installation)		BASE RATE	$26.86
		FRINGE BENEFITS	17.08
SPRINKLER FITTERS:			
(Fire Sprinklers)		BASE RATE	$30.14
		FRINGE BENEFITS	17.12

TRUCK DRIVERS / BUILDING:

10 Yard Truck:	BUILDING	BASE RATE	$16.27
		FRINGE BENEFITS	1.50
Dump Truck:	BUILDING	BASE RATE	$15.47
		FRINGE BENEFITS	2.74

TRUCK DRIVER / HEAVY HIGHWAY:

Driver:	HEAVY & HIGHWAY	BASE RATE	$15.85
		FRINGE BENEFITS	4.60
Euclid Wagon, End Dump, Lowboy, Heavy Duty Equipment, Tractor-Trailer Combination, & Drag:			
	HEAVY & HIGHWAY	BASE RATE	$16.29
		FRINGE BENEFITS	4.60

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CR 2-023 2014
DECEMBER 22, 2014

DIVISION 01

GENERAL REQUIREMENTS

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SECTION 011100 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SCOPE OF WORK PERFORMED UNDER THIS CONTRACT

This project consists of the construction of a new sodium hypochlorite chemical feed building, the demolition of an existing chemical feed building, the installation of buried chemical feed piping, a precast concrete chemical feed vault, and chemical feed taps to existing water mains. The new sodium hypochlorite building will include a bulk storage tank, transfer pumps, day storage tanks, metering pumps, associated chemical feed piping, valves and accessories, and associated electrical and instrumentation work.

1.2 ENUMERATION OF DRAWINGS & SPECIFICATIONS

Following are the Drawings and Specifications which form the Contract Documents as set forth in Section 1.1 of the General Conditions:

Drawings	Sheet Number
See Sheet G-001 Drawing Index	

Specifications

See Table of Contents

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 011100

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SECTION 011400 - GENERAL PROVISIONS

PART 1 - GENERAL

1.1 DESIGNATION OF PARTIES

A. All references in the Specifications, Contract Documents and Drawings to "Owner" shall mean the Northern Kentucky Water District; all references to "Engineer" shall mean GRW Engineers, Inc., 801 Corporate Drive, Lexington, Kentucky 40503.

1.2 EXPERIENCE CLAUSE

A. Wherever experience is required of equipment manufacturers in manufacturing or in records of satisfactory operation for a specified period of time, in lieu of the experience, the manufacturer may furnish a 100 percent (100%) performance guarantee bond or a cash deposit. The bond or cash deposit provided by the manufacturer shall guarantee replacement of the equipment process in the event of failure or unsatisfactory service. The period of time for which the bond or cash deposit is required shall be the same as the experience period of time specified.

1.3 ACCESS TO INSPECTION OF WORK

A. Representatives of the State Department of Health, the State Department for Natural Resources and Environmental Protection, local public health agencies, Owner, and Engineer shall at all times have full access to the project site for inspection of the work accomplished under this Contract and for inspection of all materials intended for use under the Contract. The Contractor shall provide proper facilities for such access and inspection.

1.4 EQUIPMENT LUBRICATION

A. The Contractor shall make suitable provision for the proper lubrication of all equipment furnished under this Contract. Accessible grease fittings shall be provided where required. A supply of oil, grease and other lubricants of proper quality, as recommended by the manufacturer of the equipment, shall be furnished. Lubricants shall be furnished in their original, unopened containers, in sufficient quantity for initial fillings and for at least one (1) year of operation.

1.5 PRE-CONSTRUCTION CONFERENCE

A. The Contractor, Engineer and Owner, or their duly appointed representative, shall meet in a preconstruction conference prior to the initiation of construction to organize, schedule and determine responsibilities for the work as it pertains to each party of the Contract.

1.6 CONSTRUCTION SCHEDULE CHART

A. Prior to start of any construction, the Contractor shall furnish a construction schedule or progress chart. The schedule or chart shall be subject to the approval of the Engineer, and be of sufficient detail to show the chronological relationship of all activities of the project, the order in which the Contractor proposes to carry on the work, estimated starting and completion dates of major features, procurement of materials, and scheduling of equipment. The schedule shall be in a form suitable for appropriately indicating the percentage of work scheduled for completion at any time. The schedule shall be kept current and shall reflect completion of all work under the Contract within the specified time and in accordance with these Specifications.

1.7 CONSTRUCTION PROGRESS MEETINGS

A. Monthly construction progress meetings shall be held at the project site or at a designated location established by the Owner. The Contractor, appropriate Sub-Contractors, the Engineer and the Owner shall meet to review construction progress, equipment or material submittals, construction schedules, etc.

1.8 PRECONSTRUCTION PHOTOGRAPHS

A. Prior to construction and mobilization of equipment, Contractor shall take record photographs of all areas of the project site.

B. In lieu of photographs, a videographic record may be made of the project site.

1.9 SPARE PARTS

A. Spare parts for routine maintenance and minor repairs shall be provided for specified equipment items in the respective technical sections of these Specifications. Required spare parts to be provided are listed in the particular equipment Specifications.

B. Parts shall be coated to protect them from a moist atmosphere. All spare parts shall be plainly tagged, marked for identification and reordering, and shall be delivered properly boxed. Required identification includes (but is not limited to):

1. Name of the manufacturer or supplier of equipment.
2. Name of the unit for which the part is intended.
3. Name of the spare part.
4. Name of the supplier of the spare part.
5. Manufacturer's catalogue part number.
6. Precautionary information.
7. Any other identifying information deemed appropriate.

C. All spare parts for a single equipment item shall be crated together in containers suitable for handling with hoisting equipment and designed for prolonged storage and stenciled to identify contents.

D. Where oil or grease lubricated equipment is concerned, sufficient oil or grease of types recommended by the equipment manufacturer shall be supplied for one year's operation.

E. The Contractor shall furnish and deliver the spare parts to the Owner at such time as it (Owner) may direct but prior to Contract expiration date. Furnish to the Engineer for record purposes a list of spare parts delivered to the Owner.

1.10 CLEANING

A. The Contractor shall at all times keep the construction site and the surrounding area presentable to the public, and clean of rubbish caused by the Contractor's operation. At completion of the work, the Contractor shall remove all the rubbish, all tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the site clean and ready for use.

B. After completion of all work and before final acceptance of the work, the Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of the piping, equipment and all associated fabrication.

C. All waste and excess materials shall be disposed of off the project site and at no additional expense to the Owner. In no case shall waste materials (any removed concrete, piping, equipment, etc.) be buried on the site. Burning is not permitted.

D. Upon completion of the project, the Contractor is responsible for leaving the project site in as good as or better condition than the original. This includes site grading, landscaping, replacement of sidewalks, driveways, curbs, mailboxes, clotheslines, fences, etc. and removal of all construction debris.

1.11 TAXES

A. Proposals shall be made to include any applicable taxes on payrolls, materials, equipment, vehicles, utilities, etc., including State sales taxes and shall include compensation for such taxes on all work under this Contract.

1.12 LINES AND GRADES

A. The Engineer will set a benchmark or marks near the site and furnish the Contractor with the elevation of same. The Engineer will assist the Contractor in laying out the axes of the structures. The Contractor shall be responsible for all other lines and grades required for the construction of structures. The Contractor shall set line and grade stakes for all gravity sewers, offset from the centerline of the trench or the axes of the pipelines.

B. The Contractor shall use a laser beam instrument to set the grades on gravity sewer lines. In using such an instrument, the Contractor shall be responsible for maintaining grades and elevations as called for on the drawing profiles, and any variances found shall be corrected by the Contractor at its expense. The Contractor shall verify invert elevation at each manhole for a check. A blower shall be used with the laser beam instrument during warm or hot weather to assure accurate line and grade for the laser beam.

C. When water lines, process piping and other such buried pressure pipelines are involved, the Engineer will assist the Contractor in the location of these lines; however, any detailed layout requiring surveying, or excavation including that required for establishing the grade of the pipeline, shall be accomplished by the Contractor.

D. The Contractor shall furnish all materials, stakes and grade boards that are required for layout by the Contractor's forces. In addition, the Contractor shall furnish any necessary survey personnel to mark the location of the various facilities on the ground, establishing bench levels and determining as-built conditions after work is completed. The Contractor's personnel engaged in the layout work described herein and the aides furnished to the Engineer shall be fully capable of performing the duties set out herein and shall be fully qualified as required. Contractor shall be responsible for verifying all profiles and elevations prior to construction.

1.13 COMPLIANCE WITH SAFETY REGULATIONS

A. The equipment items furnished shall comply with all governing federal and state laws regarding safety, including all current requirements of the Occupational Safety and Health Act (OSHA). Contractor shall be solely responsible for job safety in accordance with all laws, regulations, methods, etc. of OSHA and the state.

1.14 MAINTENANCE AND OPERATIONS MANUAL

A. Every piece of equipment furnished and installed shall be provided with complete maintenance and operations manuals. These shall be detailed in instructions to the Owner's personnel. They shall be attractively bound for the Owner's records. See 01 33 23 and Section 01 78 23 for requirements. The manuals shall be submitted to the Engineer for review as to adequacy and completeness. Provide four copies each, unless otherwise noted.

1.15 OBSTRUCTIONS

A. In cases where storm sewers, sanitary sewers, gas lines, water lines, telephone lines, electric lines or other underground structures are encountered, they shall not be displaced or molested unless necessary, in which case they shall be replaced in as good a condition as found and as quickly as possible.

B. The Contractor is responsible for notifying the appropriate utility companies, and coordinating the protection of the utility. All such lines or underground structures damaged or molested in the construction shall be replaced at the Contractor's expense, unless in the opinion of the Engineer, such damage was caused through no fault of the Contractor.

1.16 STORAGE FACILITIES

A. The Contractor shall be responsible for proper and adequate storage of all materials and equipment used on the site. Any additional off-site space required for construction purposes shall be the Contractor’s responsibility to obtain.

B. Upon completion of the work, the Contractor shall remove all storage facilities, surplus materials and equipment and restore the site to its original condition, or to the finished condition as required by the Contract.

1.17 STANDARDS OF WORKMANSHIP

A. Work of all crafts and trades shall be laid out to lines and elevations as established by the Contractor from the Drawings or from instructions by the Engineer. Unless otherwise shown, all work shall be plumb and level, in straight lines and true planes, parallel or square to the established lines and levels. The work shall be accurately measured and fitted to tolerance as established by the best practices of the crafts and trades involved, and shall be as required to fit all parts of the work carefully and neatly together.

1.18 PERFORMANCE AND PAYMENT BONDS

A. Performance and payment bonds, as specified in of the General Conditions, shall run for a period of one (1) year after final acceptance of the work by the Owner. These bonds shall be executed on the forms provided as a part of the Contract Documents.

1.19 INITIAL START-UP AND OPERATION

A. The initial operation period provided for herein is to check and provide the satisfactory mechanical operation of the facilities. These requirements for start-up and operation in no way relieve the Contractor of its responsibility with respect to guaranty of work as specified in the "General Conditions." The manufacturer's representatives shall be present during this period to instruct the operators in the care, operation and maintenance of the equipment. When the shakedown period is completed, the Owner will assume responsibility for maintenance and operation, provided that all major items of the Work are operating satisfactorily.

B. If any or all of the facilities are not operating satisfactorily at the end of the shakedown period, the Contractor shall continue to maintain those facilities that are incomplete or not operating satisfactorily until they are complete and acceptable to the Owner. Maintenance by the Contractor shall include all mechanical facilities such as pumps and like equipment. Prior to start-up, the Contractor will be required to prepare an operating schedule detailing the proposed start-up and its plans for manpower and auxiliary facilities to be provided.

1.20 GUARANTY

A. Except as otherwise specified herein, the Contractor shall guarantee all work from latent defects in materials, equipment and workmanship for one (1) year from the date of final completion of the Contract. The date of final completion shall be that date upon which the final estimate is approved by the Owner or the date of substantial completion as defined in Section 01 77 00 of the technical Specifications. In case any date but the date of final completion is established to govern the time of the Guaranty, such date shall be duly recorded together with the terms and conditions of such agreement.

B. The Contractor agrees that it will obtain from the manufacturers of equipment and materials furnished under this Contract, guarantees against defective materials and workmanship, and if

those guarantees furnished by the manufacturer do not extend for the term of one (1) year from and after the date upon which the final estimate is formally approved by the Owner or other established date as set forth hereinbefore, it shall make the necessary arrangements and assume all cost for extending this guarantee for the required period.

C. The Contractor shall promptly make such repairs or replacement as may be required under the above specified guarantee, and, when the repairs or replacements involve one or more items of installed equipment, shall provide the services of qualified factory-trained servicemen in the employ of the equipment manufacturers to perform or supervise the repairs or replacements.

D. When the Engineer or the Owner deems it necessary, and so orders, such replacements or repairs under this section shall be undertaken by the Contractor within twenty-four (24) hours after service of notice. If the Contractor unnecessarily delays or fails to make the ordered replacements or repairs within the time specified, or if any replacements or repairs are of such nature as not to admit of the delay incident to the service of a notice, then the Owner shall have the right to make such replacements or repairs, and the expense thereof shall be paid by the Contractor or deducted from any moneys due the Contractor.

E. The Performance Bond shall remain in full force and effect throughout the Guaranty period.

F. All warranties and guarantees remaining in effect at and beyond the Guaranty expiration date shall be relinquished and transferred to the Owner. Copies of such warranty/guaranty shall be submitted to the Engineer prior to date of the start of the guaranty period.

1.21 TRAFFIC CONTROL AND MAINTENANCE

A. Traffic shall be maintained on all highways and streets at all times during construction of pipe lines across or along side said highways and streets. Access to all existing subdivisions and private residences shall also be kept open. Work shall be performed in accordance with applicable City, County, and state Department of Transportation guidelines. Traffic control shall include proper signing and flagging per these guidelines.

B. Traffic shall be maintained in accordance with the Manual on Uniform Traffic Control Devices. Work shall include all labor and materials necessary for construction and maintenance of traffic control devices and markings.

C. Traffic control shall also include all flag persons and traffic control devices such as, but not limited to, flashers, signs, barricades and vertical panels, plastic drums (steel drums will not be permitted) and cones necessary for the control and protection of vehicular and pedestrian traffic as specified by the Manual on Uniform Traffic Control Devices.

D. Any temporary traffic control items, devices, materials, and incidentals shall remain the property of the Contractor when no longer needed.

E. The Contractor shall maintain a two-lane traveled way with a minimum lane width of 10 feet; however, during working hours, one-way traffic may be allowed at the discretion of the Engineer, provided adequate signing and flagpersons are at the location.

F. The Contractor shall fully cover with plywood any signs, either existing, permanent or temporary, which do not properly apply to the current traffic phasing, and shall maintain the covering until the signs are applicable or are removed.

G. In general, all traffic control devices shall be placed starting and proceeding in the direction of the flow of traffic and removed starting and proceeding in the direction opposite to the flow of traffic.

H. The Engineer and Contractor shall review the signing before traffic is allowed to use lane closures, crossovers, or detours, and all signing shall be approved by the Engineer before work can be started by the Contractor.

I. If traffic should be stopped due to construction operations and an emergency vehicle on an official emergency run arrives on the scene, the Contractor shall make provisions for the passage of that vehicle immediately.

1.22 FLOOD INSURANCE

A. Contractor is required to carry flood insurance for projects which are located in designated flood hazard areas unless Federal Flood Insurance is not available.

1.23 UTILITY LINE ACTIVITIES COVERED UNDER NATIONWIDE PERMIT # 12

A. All activities involving utility line construction covered under the US Army Corps of Engineers NATIONWIDE PERMIT # 12 shall meet the following conditions:

1. Utility Line Activities. Activities required for the construction, maintenance, repair, and removal of utility lines and associated facilities in waters of the United States, provided the activity does not result in the loss of greater than 1⁄2-acre of waters of the United States for each single and complete project. Utility lines: This NWP authorizes the construction, maintenance, or repair of utility lines, including outfall and intake structures, and the associated excavation, backfill, or bedding for the utility lines, in all waters of the United States, provided there is no change in pre-construction contours. This NWP also authorizes temporary structures, fills, and work necessary to conduct the utility line activity.

2. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary structures, work, and discharges, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The areas affected by temporary fills must be revegetated, as appropriate.

3. Notification: The permittee must submit a pre-construction notification to the US Army Corps district engineer prior to commencing the activity if any of the following criteria are met: (1) The activity involves mechanized land clearing in a forested wetland for the utility line right-of-way; (2) a section 10 permit is required; (3) the utility line in waters of the United States, excluding overhead lines, exceeds 500 feet; (4) the utility line is

placed within a jurisdictional area (i.e., water of the United States), and it runs parallel to or along a stream bed that is within that jurisdictional area; (5) discharges that result in the loss of greater than 1/10-acre of waters of the United States; (6) permanent access roads are constructed above grade in waters of the United States for a distance of more than 500 feet; or (7) permanent access roads are constructed in waters of the United States with impervious materials.

B. All activities involving utility line construction covered under KENTUCKY GENERAL CERTIFICATION of Nationwide Permit # 12 shall meet the following conditions:

The general Water Quality Certification applies to surface waters of the Commonwealth as defined in 401KAR10:001 Chapter 10, Section 1(80): Surface waters means those waters having well-defined banks and beds, either constantly or intermittently flowing, lakes and impounded waters; marshes and wetlands; and any subterranean waters flowing in well-defined channels and having a demonstrable hydrologic connection with the surface.

1. The activity will not occur within surface waters of the Commonwealth identified by the Kentucky Division of Water as Outstanding State or National Resource Water, Cold Water Aquatic Habitat, or Exceptional Waters.

2. The activity will not occur within surface waters of the Commonwealth identified as perpetually-protected (e.g. deed restriction, conservation easement) mitigation sites.

3. This general water quality certification does not authorize the installation of utility lines in a linear manner within the stream channel or below the top of the stream bank.

4 For a single crossing, impacts from the construction and maintenance corridor in surface waters shall not exceed 50 feet of bank disturbance.

5. This general certification shall not apply to nationwide permits issued for individual crossings which are part of a larger utility line project where the total cumulative impacts from a single and complete linear project exceed ½ acre of wetlands or 300 linear feet of surface waters. Cumulative impacts include utility line crossings, permanent or temporary access roads, headwalls, associated bank stabilization areas, substations, pole or tower foundations, maintenance corridor, and staging areas.

6. Stream impacts under Conditions 4 and 5 of this certification are defined as the length of bank disturbed. For the utility line crossing and roads, only one bank length is used in calculation of the totals.

7 Stream impacts covered under this General Water Quality Certification and undertaken by those persons defined as an agricultural operation under the Agricultural Water Quality Act must be completed in compliance with the Kentucky Agricultural Water Quality Plan (KWQP).

8. The Kentucky Division of Water may require submission of a formal application for an individual certification for any project if the project has been determined to likely have a significant adverse effect upon water quality or degrade the waters of the Commonwealth so that existing uses of the water body or downstream waters are precluded.

9. Activities that do not meet the conditions of this General Water Quality Certification require an Individual Section 401 Water Quality Certification.

10. Blasting of stream channels, even under dry conditions, is not allowed under this general water quality certification.

11. Utility lines placed parallel to the stream shall be located at least 50 feet from an intermittent or perennial stream, measured from the top of the stream bank. The cabinet may allow construction within the 50 foot buffer if avoidance and minimization efforts are shown and adequate methods are utilized to prevent soil from entering the stream.

12. Utility line stream crossings shall be constructed by methods that maintain flow and allow for a dry excavation. Water pumped from the excavation shall be contained and allowed to settle prior to re-entering the stream. Excavation equipment and vehicles shall operate outside of the flowing portion of the stream. Spoil material from the excavation shall not be allowed to enter the flowing portion of the stream.

13. The activities shall not result in any permanent changes in pre-construction elevation contours in surface waters or wetlands or stream dimension, pattern or profile.

14. Utility line activities which impact wetlands shall not result in conversion of the area to non-wetland status. Mechanized land clearing of forested wetlands for the installation or maintenance of utility lines is not authorized under this certification.

15. Activities qualifying for coverage under this General Water Quality Certification are subject to the following conditions:

    a. Erosion and sedimentation pollution control plans and Best Management Practices must be designed, installed, and maintained in effective operating condition at all times during construction activities so that violations of state water quality standards do not occur.
    b. Sediment and erosion control measures, such as check-dams constructed of any material, silt fencing, hay bales, etc., shall not be placed within surface waters of the Commonwealth, either temporarily or permanently, without prior approval by the Kentucky Division of Water's Water Quality Certification Section. If placement of sediment and erosion control measures in surface waters is unavoidable, design and placement of temporary erosion control measures shall not be conducted in such a manner that may result in instability of streams that are adjacent to, upstream, or downstream of the structures. All sediment and erosion control devices shall be removed and the natural grade restored within the completion timeline of the activities.
    c. Measures shall be taken to prevent or control spills of fuels, lubricants, or other toxic materials used in construction from entering the watercourse.
    d. Removal of riparian vegetation shall be limited to that necessary for equipment access.
    e. To the maximum extent practicable, all in-stream work under this certification shall be performed under low-flow conditions.
    f. Heavy equipment, e.g. bulldozers, backhoes, draglines, etc., if required for this project, should not be used or operated within the stream channel. In those instances in which such in-stream work is unavoidable, then it shall be performed in such a

manner and duration as to minimize turbidity and disturbance to substrates and bank or riparian vegetation.

g. Any fill shall be of such composition that it will not adversely affect the biological, chemical, or physical properties of the receiving waters and/or cause violations of water quality standards. If rip-rap is utilized, it should be of such weight and size that bank stress or slump conditions will not be created because of its placement.

h. If there are water supply intakes located downstream that may be affected by increased turbidity and suspended solids, the permittee shall notify the operator when such work will be done.

i. Should evidence of stream pollution or jurisdictional wetland impairment and/or violations of water quality standards occur as a result of this activity (either from a spill or other forms of water pollution), the Kentucky Division of Water shall be notified immediately by calling (800) 928-2380.

16. Non-compliance with the conditions of this general certification or violation of Kentucky state water quality standards may result in civil penalties.

1.24 PROTECTION OF VEGETATION

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

1.25 PIPE AND MANHOLE REPLACEMENT

A. Where indicated in the Contract Documents, pipe and manholes to be replaced shall be removed from the site and disposed of by the Contractor. Material shall not be placed back in the trench or buried on the site.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 011400

SECTION 011410 - SPECIAL PROVISIONS

PART 1 - GENERAL

1.1 SUBSURFACE DATA

All soundings, boring logs, or other data pertaining to the subsurface conditions as referred to in the Drawings and Specifications is believed to be reasonably correct. However, the Engineer does not guarantee the accuracy or adequacy of such information.

Copies of reports entitled "Geotechnical Exploration Report, Sodium Hypochlorite Building, NKWD Dudley Complex" will be provided as Appendix "A" of these specifications and are also available for inspection at the offices of GRW Engineers, Inc., Lexington, KY 40503.

NOTE WELL:

Bidders and prospective bidders are hereby warned and put on notice that the borings and soundings referred to above were made for design purposes only. They were not made for the purpose of informing bidders and prospective bidders as to subsurface conditions in the area of the work covered by these contracts and are not, in the opinion of the Engineer, sufficient or extensive enough to provide any accurate or reliable indication of subsurface conditions in the area covered by the work to be performed under these contracts other than at the location of the borings referred to. In bidding on this Contract, each bidder acknowledges that it has made whatever investigation of subsurface conditions it has deemed necessary for the purposes of bidding. The Contractor is urged to make such investigations as it deems necessary to ascertain the subsurface conditions to be encountered in the work.

1.2 SEQUENCE OF WORK, CONTINUOUS OPERATION

The existing chemical feed equipment shall remain in continuous operation during the construction of the new chemical feed building, feed piping and feed vault until the new feed equipment is fully tested and in operation. Contractor shall sequence all work to avoid downtime of the existing chemical feed equipment. Minimum downtime may be allowed if first coordinated with, and approved by, the Northern Kentucky Water District. The extent of any downtime shall be minimized.

1.3 EXISTING CHEMICAL FEED BUILDING DEMOLITION

Contractor shall not begin demolition of the existing chemical feed building until three (3) weeks after the new chemical feed equipment is fully tested and in operation. The Owner will remove any equipment that they wish to salvage from the existing building during this time. All demolition materials shall be hauled off site and properly disposed of in accordance with all applicable local, state and federal laws and regulations.

1.4 START-UP AND OWNER TRAINING

Addendum No. 1 *(4/27/15) After each piece of equipment is successfully started-up, training shall be administered on each piece of equipment by the particular piece of equipment's factory Representative. O&M Manuals shall be reviewed and approved by Owner and Engineer before startup and training. Complete payment for a piece of equipment shall not be made until an O&M manual is submitted and approved, the piece of equipment is successfully started up, and the owner is satisfactorily trained.*

~~After each piece of equipment is successfully started-up, the Contractor shall "Video Tape" the Owner's training administered by the particular piece of equipment's factory Representative. The tape shall be give to the Owner for future reference. O&M Manuals shall be reviewed and approved by Owner and Engineer before startup and training. Complete payment for a piece of equipment shall not be made until an O&M manual is submitted and approved, the piece of equipment is successfully started up, and the owner is satisfactorily trained.~~

1.5 SUBSTITUTE OR "OR-EQUAL" ITEMS

Whenever it is indicated in the Drawings or specified in the Specifications that a substitute "or-equal" item of material or equipment may be furnished or used by contractor if acceptable to Engineer, application for such acceptance will not be considered by Engineer until after the Effective Date of the Agreement. To be considered by the Engineer, Contractor must provide to the Engineer for approval redline markup versions of drawings and specifications showing proposed "equal" items to detail them to meet the characteristics of the specified items.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 011410

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes administrative and procedural requirements governing allowances. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Lump-sum allowances.

C. The following allowances shall be included in the Contractors bid:

1. Brick unit cost allowance - $650 per thousand for face brick (see Spec Section 04200).

2. Repair and Asphalt Paving of Rodgers Road - $30,000 (in accordance with Spec Section 331216).
   - Based on the potential damage that may occur from delivery of materials and work trucks entering the project site from Rodgers Road, the Owner would like to see proposals from Asphalt Paving subcontractors to complete repairs and repaving, if any as determined by the Owner.

3. Any amount of the allowance not used will be removed from total contract price during the final adjusting change order.

1.2 RELATED DOCUMENTS

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

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise the Engineer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At the Owner’s request, obtain proposals for each allowance for use in making final selections and include recommendations that are relevant to performing the Work.

C. Coordinate execution of the allowance work by the Sub-contractor selected by the Owner.

1.4 SUBMITTALS

A. Contractor shall submit three (3) separate proposals from qualified local Asphalt Paving Companies for Owner to review and choose from.

B. Submit invoices or purchase orders to show actual work completed in fulfillment of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP-SUM ALLOWANCES

A. In accordance with Paragraph 11.02 of the General Conditions, the Contractor's costs for overhead, profit, and other expenses in relation to the cash allowances have been included in the Contract Price and not in the allowances.

1.7 UNUSED MATERIALS

A. Contractor shall be responsible for returning unused materials purchased under an allowance to the manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

B. When it is not economically practical to return material for credit, Contractor shall be responsible for preparing and delivering unused material to Owner's designated storage location. Otherwise, disposal of unused material shall be Contractor's responsibility.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

END OF SECTION 012100

SECTION 012213 - BASIS OF MEASUREMENT AND PAYMENT - LUMP SUM

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. The Contractor shall furnish all necessary labor, machinery, tools, apparatus, equipment, materials, service and other necessary supplies and perform all Work shown on the Drawings and/or described in the Specifications and Contract Documents at the lump sum price as indicated by the Bidder in the Bid.

B. The Bidder declares that it has examined the site of the Work and informed himself fully in regard to all conditions pertaining to the place where the Work is to be done; that it has examined the Plans, Specification and Contract Documents for the Work, and has read all special provisions furnished prior to the opening of bids; and that it has further satisfied himself relative to the Work to be performed.

C. All excavation required of the work shall be done as part of the total price for the complete project. All excavation shall be unclassified.

D. Owner shall make payments on account of the Contract Price on the basis of Contractor's Applications for Payment as recommended by Engineer, on or about the 30th day of each month during construction. All progress payments will be on the basis of the progress of the Work measured by the Schedule of Values established in Paragraph 2.07 of the General Conditions or, in the event there is no schedule of values, as provided in the General Requirements.

E. The Progress Payments shall include the cost of Stored Materials, LESS an amount of retainage equal to 10% of their total cost. Stored materials are defined as materials and equipment not incorporated in the Work but delivered, suitably stored and accompanied by documentation satisfactory to Owner as provided in Paragraph 14.02A of the General Conditions.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012213

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SECTION 012500 - PRODUCTS AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. General: Substitution of materials and/or equipment is defined in Paragraph 6.7.1 of the General Conditions and more fully hereinafter.

B. Definitions: Definitions used in this paragraph are not intended to negate the meaning of other terms used in the Contract Documents including such terms as "specialties", "systems", "structure", "finishes", "accessories", "furnishings", "special construction" and similar terms. Such terms are self-explanatory and have recognized meanings in the construction industry.

1. "Products" are items purchased for incorporation in the Work, regardless of whether they were specifically purchased for the project or taken from the Contractor's previously purchased stock. The term "product" as used herein includes the terms "material", "equipment", "system" and other terms of similar intent.
2. "Named Products" are products identified by use of the manufacturer's name for a product, including such items as a make or model designation, as recorded in published product literature, of the latest issue as of the date of the Contract Documents.
3. "Materials" are products that must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form units of work.
4. "Equipment" is defined as a product with operational parts, regardless of whether motorized or manually operated, and in particular, a product that requires service connections such as wiring or piping.

C. Substitutions: The Contractor's requests for changes in the products, materials, equipment and methods of construction required by the Contract Documents are considered requests for "substitutions", and are subject to the requirements specified herein. The following are not considered as substitutions:

1. Revisions to the Contract Documents, where requested by the Owner, Engineer are considered as "changes" not substitutions.
2. Substitutions requested during the bidding period, which have been accepted prior to the Contract Date, are included in the Contract Documents and are not subject to the requirements for substitutions as herein specified.
3. Specified Contractor options on products and construction methods included in the Contract Documents are choices available to the Contractor and are not subject to the requirements for substitutions as herein specified.
4. Except as otherwise provided in the Contract Documents, the Contractor's determination of and compliance with governing regulations and orders as issued by governing authorities do not constitute "substitutions" and do not constitute a basis for change orders.

D. Standards: Refer to Division-01 section "Definitions and Standards" for applicability of industry standards to the products specified for the project, and for acronyms used in the text of the specification sections.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-01 Specification sections, apply to Work of this Section.

1.3 SUBMITTALS

The information required to be furnished for evaluation of product substitution will be as follows:

A. Performance capabilities, and materials and construction details will be evaluated based upon conformance with the Specifications. Products that do not conform with the Specification shall not be accepted.

B. Manufacturer's production and service capabilities, and evidence of proven reliability will be acceptable if the following is furnished.

1. Written evidence that the manufacturer has not less than (3) years experience in the design and manufacture of the substitute product.
2. Written evidence of at least one application, of a type and size similar to the proposed substitute product, in successful operation in a wastewater treatment plant for a period of at least one year.
3. In lieu of furnishing evidence of a manufacturer's Experience and successful operation of an application of the product to be substituted, the Contractor has the option of furnishing a cash deposit or bond which will guarantee replacement if the product the furnished does not satisfy the other requirements specified in this section. The amount of each deposit or bond will be subject to the approval.

C. Specific reference to characteristics either superior or inferior to specified requirements will be evaluated based on their net effect on the project. Products with any characteristics inferior to those specified will not be acceptable unless offset by characteristics that, in the opinion of the Engineer, will cause the overall effect of the product on the project to be at least equal to that of those specified.

1.4 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work.

B. Compatibility of Options: Compatibility of products is a basic requirement of product selection. When the Contractor is given the option of selecting between two or more products for use on the project, the product selected must be compatible with other products previously selected, even if the products previously selected were also Contractor options. The complete compatibility between the various choices available to the Contractor is not assured by the various requirements of the Contract Documents, but must be provided by the Contractor.

C. The detailed estimate of operating and maintenance costs will be evaluated based on comparison with similar data on the specified products. Proposed substitute products which have an operating and maintenance cost that, in the opinion of the Engineer, exceeds that of the specified products will not be considered equal and will not be acceptable.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

General: Deliver, store, and handle products in accordance with manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft. Control delivery schedules to minimize long-term storage at the site and to prevent overcrowding of construction spaces. In particular coordinate delivery and installation to ensure minimum holding or storage times for items known or recognized to be flammable, hazardous, easily dam aged, or sensitive to deterioration, theft and other sources of loss.

A. Deliver products to the site in the manufacturer's sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.

B. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

C. Store heavy materials away from the project structure in a manner that will not endanger the supporting construction.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT COMPLIANCE

A. General: Requirements for individual products are indicated in the Contract Documents; compliance with these requirements is in itself a Contract Requirement. These requirements may be specified in any one of several different specifying methods, or in any combination of these methods. These methods include the following:

1. Proprietary.
2. Descriptive.
3. Performance.
4. Compliance with Reference Standards.

Compliance with codes, compliance with graphic details, allowances, and similar provisions of the Contract Documents also have a bearing on the selection process.

B. Procedures for Selecting Products: Contractor's options in selecting products are limited by requirements of the Contract Documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects.

2.2 SUBSTITUTIONS

A. Conditions: Contractor's request for substitution will be received and considered when extensive revisions to the Contract Documents are not required, when the proposed changes are in keeping with the general intent of the Contract Documents, when the request are timely, fully documented and properly submitted, and when one or more of the following conditions is satisfied, all as judged by the Engineer; otherwise the requests will be returned without action except to record non-compliance with these requirements.

1. The Engineer will consider a request for substitution where the request is directly related to an "or equal" clause or similar language in the Contract Documents.
2. The Engineer will consider a request for substitution where the specified product or method cannot be provided within the Contract Time. However, the request will not be considered if the product or method cannot be provided as a result of the Contractor's failure to pursue the work promptly or to coordinate the various activities properly.
3. The Engineer will consider a request for substitution where the specified product or method cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
4. The Engineer will consider a request for a substitution where a substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. These additional responsibilities may include such considerations as additional compensation to the Engineer for redesign and evaluation services, the increased cost of other work by the Owner or separate contractors, and similar considerations.
5. The Engineer will consider a request for substitution when the specified product or method cannot be provided in a manner which is compatible with other materials of the work, and where the Contractor certifies that the substitution will overcome the incompatibility.
6. The Engineer will consider a request for substitution when the specified product or method cannot be properly coordinated with other materials in the work, and where the Contractor certifies that the proposed substitution can be properly coordinated.
7. The Engineer will consider a request for substitution when the specified product or method cannot receive a warranty as required by the Contract Documents and where the Contractor certifies that the proposed substitution receive the required warranty.
8. The Contractor shall reimburse the Owner any costs for review by the Engineer of proposed product substitutions which require major design changes, as determined by the Owner, to related of adjacent work made necessary by the proposed substitutions.

B. Work-Related Submittals: Contractor's submittal of and the Engineer's acceptance of shop drawings, product data or samples which relate to work not complying with requirements of the Contract Documents, does not constitute an acceptable or valid request for a substitution, nor approval thereof.

2.3 GENERAL PRODUCT REQUIREMENTS

A. General: Provide products that comply with the requirements of the Contract Documents and that are undamaged and, unless otherwise indicated, unused at the time of installation. Provide products that are complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

1. Standard Products: Where they are available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
2. Continued Availability: Where, because of the nature of its application, the Owner is likely to need replacement parts or additional amounts of a product at a later date, either for maintenance and repair or replacement, provide standard, domestically produced products for which the manufacturer has published assurances that the products and its parts are likely to be available to the Owner at a later date.

B. Nameplates: Except as otherwise indicated for required labels and operating data, do not permanently attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view either in occupied spaces or on the exterior of the completed project.

1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface which, in occupied spaces, is not conspicuous.
2. Equipment Nameplates: Provide permanent nameplate on each item of service-connected or power operated equipment. Locate the nameplate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data.

    a. Name of manufacturer
    b. Name of product
    c. Model number
    d. Serial number
    e. Capacity
    f. Speed
    g. Ratings

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. General: Except as otherwise indicated in individual sections of these Specifications, comply with the manufacturer's instructions and recommendations for installation of the products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other work. Clean exposed surfaces and protect surfaces as necessary to ensure freedom from damage and deterioration at Time of Acceptance.

END OF SECTION 012500

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SECTION 013113 - PROJECT COORDINATION

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

Minimum administrative and supervisory requirements necessary for coordination of work on the project include but are not necessarily limited to the following:

A. Coordination and meetings.

B. Limitations for use of site.

C. Coordination of crafts, trades and subcontractors.

D. General installation provisions.

E. Cleaning and protection.

F. Conservation and salvage.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

1.3 COORDINATION AND MEETINGS

A. Monthly general project coordination meetings will be held at regularly scheduled times convenient for all parties involved. These meetings are in addition to specific meetings held for other purposes, such as regular project meetings and special pre-installation meetings. Representation at each meeting by every party currently involved in coordination or planning for the work of the entire project is requested. Meetings shall be conducted in a manner which will resolve coordination problems. Results of the meeting shall be recorded and copies distributed to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.4 LIMITATIONS ON USE OF THE SITE

A. Limitations on site usage as well as specific requirements that impact site utilization are indicated on the drawings and by other contract documents. In addition to these limitations and requirements, allocation of available space shall be administered equitably among entities needing both access and space so as to produce the best overall efficiency in performance of the total work of the project. Schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

1.5 COORDINATION OF CRAFTS, TRADES AND SUBCONTRACTORS

A. The Contractor shall coordinate the work of all the crafts, trades and subcontractors engaged on the work, and it shall have final responsibility as regards the schedule, workmanship and completeness of each and all parts of the work.

B. All crafts, trades and subcontractors shall be made to cooperate with each other and with others as they may be involved in the installation of work which adjoins, incorporates, precedes or follows the work of another. It shall be the Contractor's responsibility to point out areas of cooperation prior to the execution of subcontractor agreements and the assignment of the parts of the work. Each craft, trade and subcontractor shall be made responsible to the Owner, for furnishing embedded items and giving directions, for doing all cutting and fitting and making all provisions for accommodating the work, and for protecting, patching, repairing and cleaning as required to satisfactorily perform the work.

C. The Contractor shall be responsible for all cutting, digging and other action of its subcontractors and workmen. Where such action impairs the safety or function of any structure or component of the project, the Contractor shall make such repairs, alterations and additions as will, in the opinion of the Engineer, bring said structure or component back to its original design condition at no additional cost to the Owner.

D. Each subcontractor is expected to be familiar with the General Requirements and all sections of the detailed Specifications for all other trades and to study all Drawings applicable to its work including Architectural and Structural Drawings, to the end that complete coordination between trades will be effected. Consult with the Engineer if conflicts exist on the Drawings.

E. Special attention shall be given to points where ducts or piping must cross other ducts or piping, where lighting fixtures must be recessed in ceilings and where ducts, piping and conduits must fit into walls and columns. It shall be the responsibility of such subcontractor to leave the necessary room for other trades.

F. No extra compensation will be allowed to cover the cost of removing piping, conduit, ducts, etc., or equipment found encroaching on space required by others.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 013113

SECTION 013213 - CONTRACTORS SEQUENCE OF CONSTRUCTION SCHEDULE – WATER PLANT

PART 1 - GENERAL

1.1 CONTRACTOR'S CONSTRUCTION SEQUENCE, SCHEDULE & PROVISIONS

The Contractor shall be responsible for all planning, coordination and execution of the work. The sequence of work shall provide assurances that reliable chemical feed operation will be maintained and such sequences shall be approved by the Owner and the Engineer. No cost or schedule adjustments shall be given for changes to the construction sequence not approved by the Owner and Engineer.

The Contractor's proposed construction sequence schedule must allow the Owner to maintain full operation of their existing chemical feed system during the construction period of the new sodium hypochlorite building. The Contractor shall take all necessary precautions to minimize if not totally eliminate, the disruption in existing chemical feed operations. When a disruption in the operations is required, the Contractor shall coordinate in advance (5 days minimum) the interruption with the Owner and the Engineer. The interruptions shall be held to a minimum by wise and prudent coordination of the Contractor's work efforts. Some items of new construction will have to be completed prior to the removal from service and/or renovation of existing facilities.

The contractor shall be responsible for all damages brought about by the disruption of the operation if such disruptions are a direct cause of Contractor negligence and/or a failure of the Contractor to coordinate its work effort to minimize and/or eliminate disruptions in service.

Some general constraints to the Contractor's construction sequence are noted as follows:

A. Contractor shall not completely demolish the existing communications and electrical lines to/ from the existing chemical feed building until the new chemical feed equipment is fully tested and in operation.

B. Contractor shall not begin demolition of the existing chemical feed building until three (3) weeks after the new chemical feed equipment is fully tested and in operation. The Owner will remove any equipment that they wish to salvage from the existing building during this time. All demolition materials shall be hauled off site and properly disposed of in accordance with all applicable local, state and federal laws and regulations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 013213

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SECTION 013216 - PROGRESS SCHEDULES

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. Scheduling Responsibilities:

1. In order to provide a definitive basis for determining job progress, a construction schedule of a type approved by the Owner will be used to monitor the project.
2. The Contractor shall be responsible for preparing the schedule and updating on a monthly basis. It shall at all times remain the Contractor's responsibility to schedule and direct its forces in a manner that will allow for the completion of the work within the contractual period.

B. Construction Hours:

1. No work shall be done between 6:00 p.m. and 7:00 a.m. nor on Saturdays, Sundays or legal holidays without the prior written permission of the Owner. However, emergency work may be done without prior written permission.
2. If the Contractor, for its convenience and at its own expense, should desire to carry on its work at night or outside the regular hours, it shall submit a written request to the Engineer and shall allow nine (9) days for satisfactory arrangements to be made for inspecting the work in progress. If permission is granted, the Contractor shall light the different parts of the project as required to comply with all applicable federal, state, and local regulations. The Contractor shall also revise its schedule as appropriate at the next monthly schedule update meeting to reflect the changes in working hours.

C. Progress of the Work:

1. The work shall be started within ten (10) days following the Notice to Proceed and shall be executed with such progress as may be required to prevent delay to other Contractors or to the general completion of the project. The work shall be executed at such times and in or on such parts of the project, and with such forces, material and equipment, to assure completion of the work in the time established by the Contract.
2. The Contractor agrees that whenever it becomes apparent from the current monthly schedule update that delays have resulted and, hence, that the Contract completion date will not be met or when so directed by the Owner, it will take some or all of the following actions at no additional cost to the Owner:

    a. Increase construction manpower in such quantities and crafts as will substantially eliminate the backlog of work.
    b. Increase the number of working hours per shift, shifts per working day or days per week, the amount of construction equipment, or any combination of the foregoing to substantially eliminate the backlog of work.
    c. Reschedule activities to achieve maximum practical concurrency of accomplishment of activities, and comply with the revised schedule.
    d. The Contractor shall submit to the Owner or the Owner's representative for review a written statement of the steps it intends to take to remove or arrest the delay to

the critical path in the accepted schedule. If the Contractor should fail to submit a written statement of the steps it intends to take or should fail to take such steps as required by the Contract, the Owner may direct the level of effort in manpower (trades), equipment, and work schedule (overtime, weekend and holiday work, etc.), to be employed by the Contractor in order to remove or arrest the delay to the critical path in the accepted schedule, and Contractor shall promptly provide such level of effort at no additional cost to the Owner.

1.2 CONSTRUCTION SCHEDULE

A. Within ten (10) calendar days of the Notice to Proceed, the Contractor shall submit to the Engineer five (5) copies of its proposed schedule. The schedule will be the subject of a schedule review meeting with the Contractor, the Engineer and the Owner or the Owner's representative within one (1) week of its submission. The Contractor will revise and resubmit the schedule until it is acceptable and accepted by the Owner or the Owner's representative.

1.3 SUBMITTAL SCHEDULE

A. In addition to the above scheduling requirements, the Contractor will be required to submit a complete and detailed listing of anticipated submittals during the course of the Contract. The Contractor will coordinate its submittals with those of its Subcontractors and Suppliers and will identify each submittal by Contract drawing number and specification number. The anticipated submission date for each submittal must be indicated along with the date on which its return is anticipated. For planning purposes, the Engineer will usually return shop drawings thirty (30) days after receipt. However, longer durations for review will not be considered a basis for a claim.

B. The Submittal Schedule must be submitted within twenty (20) working days of the Notice to Proceed and will be the subject of a special meeting with the Engineer and the Owner or the Owner's representative within one (1) week of the schedule's submission. At that meeting, the Submittal Schedule will be reviewed for comprehensiveness and feasibility. The Engineer will adjust the projected return dates based on the need for more or less time for each submittal's review. The Submittal Schedule will then be accepted or revised as required.

1.4 SCHEDULE UPDATES

A. Monthly Meetings:

1. A monthly Schedule Update Meeting will be held in conjunction with the applicable progress meeting at the construction site to review and update the Schedule. The Schedule Update Meetings will be chaired by the Owner or the Owner's representative and attended by the Contractor and the Engineer. Actual progress of the previous month will be recorded and future activities will be reviewed. The duration of activities and their logical connections may be revised as needed. Decisions made at these meetings and agreed to by all parties are binding with the exception that no contractual completion dates will be modified without formal written requests and acceptance as specified herein.

B. Revisions to Schedule:

1. The Schedule shall be formally revised if any of the following conditions are encountered:

a. When a delay in completion of any work item or sequence of work items results in an indicated extension of the project completion.
b. When delays in submittals or deliveries or work stoppages are encountered which make replanning or rescheduling of the work necessary.
c. When the schedule does not represent the actual prosecution and progress of the project.

1.5 CONTRACT COMPLETION TIME

A. Causes for Extensions:

1. The Contract completion time will be adjusted only for causes specified in this Contract. In the event the Contractor requests an extension of any Contract completion date, it shall furnish such justification and supporting evidence as the Owner or the Owner's representative may deem necessary for a determination as to whether the Contractor is entitled to an extension of time under the provisions of this Contract. The Owner, with the assistance of the Engineer, will, after receipt of such justification and supporting evidence, make findings of fact and will advise the Contractor in writing thereof.

B. Requests for Time Extension:

1. Each request for change in any Contract completion date shall be initially submitted to the Owner within the time frame stated in the General Conditions. All information known to the Contractor at that time concerning the nature and extent of the delay shall be transmitted to the Owner at that time. Within the time frame stated in the General Conditions but before the date of final payment under this Contract, all information as required above concerning the delay must be submitted to the Owner. No time extension will be granted for requests which are not submitted within the foregoing time limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 013216

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SECTION 013323 - SHOP DRAWINGS, PRODUCT DATA, SAMPLES AND RFI'S

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. General: This section specifies procedural requirements for non- administrative submittals including shop drawings, product data, samples (when samples are specifically requested) and other miscellaneous work-related submittals. Shop drawings, product data, samples and other work-related submittals are required to amplify, expand and coordinate the information contained in the Contract Documents.

B. Refer to other Division-01 sections and other Contract Documents for Specifications on administrative, non-work-related submittals. Such submittals include, but are not limited to the following items:

1. Permits.
2. Payment applications.
3. Performance and payment bonds.
4. Insurance certificates.
5. Inspection and test reports.
6. Schedule of values.
7. Progress reports.
8. Listing of subcontractors.
9. Operating and Maintenance Manuals

C. Engineer prefers initial submittals be in electronic media along with one paper copy for review. Engineer utilizes Newforma software and will provide Contractor with the necessary links and instructions for submittal purposes. Upon completion of the review process, Contractor shall print two (2) copies of complete submittal, including transmittal cover page and stamp page, and deliver to Engineer.

If Contractor does not have capability to submit electronic submittals, then Contractor shall submit a request to Engineer for waiver. In the event a waiver is granted, paper submittals shall be provided as directed by the Engineer.

D. Submittals shall be checked and reviewed by the Contractor and stamped with Contractor's review stamp before submission to the Engineer. The review of the submittals by the Engineer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory. Review of such submittals will not relieve the Contractor of the responsibility for any errors which may exist as the Contractor shall be responsible for the dimensions and design of adequate connections, details, and satisfactory construction of all work.

E. All Requests for Information (RFI) to Engineer shall be submitted electronically via Engineer's Newforma software.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-01 Specification sections, apply to work of this section.

B. Section 017823 - Operating and Maintenance Manuals.

1.3 DEFINITIONS

A. Shop drawings are technical drawings and data that have been specially prepared for this project, including but not limited to the following items:

1. Fabrication and installation drawings.
2. Setting diagrams.
3. Shopwork manufacturing instructions.
4. Templates.
5. Patterns.
6. Coordination drawings (for use on site).
7. Schedules.
8. Design mix formulas.
9. Contractor's engineering calculations.

Standard information prepared without specific reference to a project is not considered to be shop drawings.

B. Product data includes standard printed information on manufactured products that has not been specially-prepared for this project, including but not limited to the following items:

1. Manufacturer's product specifications and installation instructions.
2. Standard color charts.
3. Catalog cuts.
4. Roughing-in diagram and templates.
5. Standard wiring diagrams.
6. Printed performance curves.
7. Operational range diagrams.
8. Mill reports.
9. Standard product operating and maintenance manuals.

C. Samples, where specifically required, are physical examples of work, including but not limited to the following items:

1. Partial sections of manufactured or fabricated work.
2. Small cuts or containers of materials.
3. Complete units of repetitively-used materials.
4. Swatches showing color, texture and pattern.
5. Color range sets.
6. Units of work to be used for independent inspection and testing.

D. Miscellaneous submittals are work-related, non-administrative submittals that do not fit in the three previous categories, including, but not limited to the following:

1. Specially-prepared and standard printed warranties.
2. Maintenance agreements.
3. Workmanship bonds.
4. Survey data and reports.
5. Testing and certification reports.
6. Record drawings.
7. Field measurement data.

1.4 SUBMITTAL PROCEDURES

A. General: Refer to the General Conditions and Paragraph 1.1 hereinbefore for basic requirements for submittal handling.

B. Coordination: Coordinate the preparation and processing of submittals with the performance of the work. Coordinate each separate submittal with other submittals and related activities such as testing, purchasing, fabrication, delivery and similar activities that require sequential activity.

It is the Contractor’s responsibility to make such field measurements as are needed to base submittals on actual field conditions to assure proper connection, fit, function and performance of all work and equipment in the execution of the contract work.

Coordinate the submittal of different units of interrelated work so that one submittal will not be delayed by the Architect/Engineer's need to review a related submittal. The Architect/Engineer reserves the right to withhold action on any submittal requiring coordination with other submittals until related submittals are forthcoming.

C. Coordination of Submittal Times: Prepare and transmit each submittal to the Architect/Engineer sufficiently in advance of the scheduled performance of related work and other applicable activities. Transmit different kinds of submittals for the same unit of work so that processing will not be delayed by the Architect/Engineer's need to review submittals concurrently for coordination.

D. Review Time: Allow sufficient time so that the installation will not be delayed as a result of the time required to properly process submittals, including time for resubmittal, if necessary. Advise the Architect/Engineer on each submittal, as to whether processing time is critical to the progress of the work and if the work would be expedited if processing time could be shortened.

1. Allow a longer time period where processing must be delayed for coordination with subsequent submittals. The Architect/Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.
2. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Architect/Engineer sufficiently in advance of the work.

E. Submittal Preparation: Mark each submittal with a permanent label for identification. Provide the following information on the label for proper processing and recording of action taken.

1. Project name.
2. Date.
3. Name and address of Architect/Engineer.
4. Name and address of Contractor.

5. Name and address of subcontractor.
6. Name and address of supplier.
7. Name of manufacturer.
8. Number and title of appropriate specification section.
9. Drawing number and detail references, as appropriate.
10. Similar definitive information as necessary.

F. All submittals shall be referenced to the applicable item, section and division of the Specifications, and to the applicable drawing(s) or drawing schedule(s). Include only one item in a submittal.

G. The Contractor shall review and check submittals, and shall indicate its review by initials and date. Any submittal received without this evidence of review shall be returned to the Contractor without review.

H. If the submittals deviate from the Contract Drawings and/or Specifications, the Contractor shall advise the Engineer in writing of the deviation and the reasons therefore.

I. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect/Engineer, and to other destinations as indicated, by use of a transmittal form. Submittals received from sources other than the Contractor will be returned to the sender "without action".

J. Electronic Submittals: If the electronic method of submittals is agreed to by Contractor, Engineer, and Owner, the format and procedures will be determined and implemented prior to any submittals. Submittals will be processed through “Newforma” software. Each item of the submittal documents shall be in .pdf format and shall be oriented so that they are read from upper left corner to lower right corner, with no rotation of said document being required after receiving it. The .pdf file shall be named so that it describes the item being submitted. All other requirements herein are part of the electronic submittal process with the exception of the duplicate copies. Contractor stamp indicating review and any comments or notes must be on the .pdf submittal.

1.5 SPECIFIC SUBMITTAL REQUIREMENTS

A. Shop drawings shall be prepared by a qualified detailer. Details shall be identified by reference to sheet and detail numbers shown on Contract Drawings. Where applicable, show fabrication, layout, setting and erection details.

Shop drawings are defined as original drawings prepared by the Contractor, subcontractors, suppliers, or distributors performing work under this Contract. Shop drawings illustrate some portion of the work and show fabrication, layout, setting or erection details of equipment, materials and components. The Contractor shall, except as otherwise noted, have prepared the number of reviewed copies required for its distribution plus four (4) which will be retained by the Engineer. Shop drawings shall be folded to an approximate size of 8-1/2" x 11" and in such manner that the title block will be located in the lower right-hand corner of the exposed surface.

B. Project data shall include manufacturer's standard schematic drawings modified to delete information which is not applicable to the project, and shall be supplemented to provide additional information applicable to the project. Each copy of descriptive literature shall be

clearly marked to identify pertinent information as it applies to the project.

C. Where samples are required, they shall be adequate to illustrate materials, equipment or workmanship, and to establish standards by which completed work is judged. Provide sufficient size and quantity to clearly illustrate functional characteristics of product and material, with integrally related parts and attachment devices, along with a full range of color samples.

D. In the event the Engineer does not specifically reject the use of material or equipment at variance to that which is shown on the Drawings or specified, the Contractor shall, at no additional expense to the Owner, and using methods reviewed by the Engineer, make any changes to structures, piping, controls, electrical work, mechanical work, etc., that may be necessary to accommodate this equipment or material. Should equipment other than that on which design drawings are based be accepted by the Engineer, shop drawings shall be submitted detailing all modification work and equipment changes made necessary by the substituted item.

E. Additional information on particular items, such as special drawings, schedules, calculations, performance curves, and material details, shall be provided when specifically requested in the technical Specifications.

F. Submittals for all electrically operated items (including instrumentation and controls) shall include complete size, color coding, all terminations and connections, and coordination with related equipment.

G. Equipment shop drawings shall indicate all factory or shop paint coatings applied by suppliers, manufacturers and fabricators; the Contractor shall be responsible for insuring the compatibility of such coatings with the field-applied paint products and systems.

H. Fastener specifications of manufacturer shall be indicated on equipment shop drawings.

I. Where manufacturers brand names are given in the Specifications for building and construction materials and products, such as grout, bonding compounds, curing compounds, masonry cleaners, waterproofing solutions and similar products, the Contractor shall submit names and descriptive literature of such materials and products it proposes to use in this Contract.

J. No material shall be fabricated or shipped unless the applicable drawings or submittals have been reviewed by the Engineer and returned to the Contractor.

K. All bulletins, brochures, instructions, parts lists, and warranties package with and accompanying materials and products delivered to and installed in the project shall be saved and transmitted to the Owner through the Engineer.

1.6 REVIEW STATUS

A. Submittals will be returned, stamped with the following classifications: "Reviewed", "Furnish as Corrected", "Revise and Resubmit", "Rejected", or “Submit Specified Item”.

B. In some instances, corrections to dimensions or clarification notations will be required, in which case the drawings will be marked "Furnish as Corrected." These shop drawings will not be required to be resubmitted for further approval. If the supplier makes additional modifications

after receiving a "Furnish as Corrected" disposition, the drawings must then be resubmitted for review.

C. If the shop drawing is returned with the notation “Revise and Resubmit”, the Contractor shall promptly make the revisions indicated and repeat the submittal approval procedure.

D. If the shop drawing is returned with the notation “Submit Specified Item”, this indicates that the submittal does not meet the specification, will not be reviewed, and is unacceptable. Upon return of a drawing so marked, the Contractor shall repeat the initial approval procedure, submitting acceptable materials or equipment.

E. The "Rejected" notation is used to indicate materials or equipment that are not acceptable and are not included in the project.

1.7 REMINDER OF CONTRACTOR RESPONSIBILITIES

A. Verify field measurements, field construction criteria, catalog numbers, and similar data.

B. Coordinate each submittal with requirements of work and of Contract Documents.

C. Notify Engineer, in writing at time of submission, of deviations in submittals from requirements of Contract Documents.

D. Begin no work, and have no material or products fabricated or shipped which requires submittals until return of submittals with Engineer's stamp and initials or signature indicating review.

E. Upon review and close-out of a submittal, Contractor shall print two (2) copies of complete submittal, including transmittal cover page and stamp page, and deliver to Engineer.

F. It is emphasized that the review of shop drawings by the Engineer is for general conformance to the Contract Drawings and Specifications, but subject to the detailed requirements of the Contract Drawings and Specifications. Although the Engineer may check submitted data in more or less detail, such checking is an effort to discover errors and omissions in the Contractor's drawings and to assist the Contractor in coordinating and expediting its work, but shall in no way relieve the Contractor of its obligation and responsibility to properly coordinate the work, and to Engineer the details of the work in such a manner, that the purpose and intent of the Contract will be achieved nor shall any such detailed checking by the Engineer be construed as placing on him or on the Owner, any responsibility for the accuracy, proper fit, functioning or performance of any phase of the work included in this Contract. The Contractor is responsible for confirmation and correlation of dimensions at the job site; for information that pertains solely to the fabrication processes or to the techniques of construction; for the coordination of the work of all trades; and for performance of its work in a safe and satisfactory manner.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 013323

SECTION 014216 - DEFINITIONS AND STANDARDS – SHORT FORM

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. This section specifies procedural and administrative requirements for compliance with governing regulations and codes and standards imposed upon the Work. These requirements include obtaining permits, licenses, inspections, releases and similar documentation, as well as payments, statements and similar requirements associated with regulations, codes and standards.

B. The term, "Regulations", is defined to include laws, statutes, ordinances and lawful orders issued by governing authorities, as well as those rules, conventions and agreements within the construction industry which effectively control the performance of the Work regardless of whether they are lawfully imposed by governing authority or not.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-01 Specification Sections, apply to Work of this Section.

1.3 DEFINITIONS

A substantial amount of specification language consists of definitions of terms found in other Contract Documents, including Drawings. (Drawings are recognized as being diagrammatic in nature and not completely descriptive of the requirements indicated thereon). Certain terms used in Contract Documents are defined in this article. Definitions and explanations contained in this section are not necessarily either complete or exclusive, but are general for the Work to the extent that they are not stated more explicitly in another element of the Contract Documents.

The provisions or requirements of other Division-01 sections apply to entire Work of the Contract and, where so indicated, to other elements which are included in the Project.

A. Indicated: The term, "indicated", is a cross-reference to graphic representations, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications, and to similar means of recording requirements in Contract Documents. Where terms such as "shown", "noted", "scheduled", and "specified" are used in lieu of "indicated", it is for the purpose of helping the reader locate the cross-reference, and no limitation of location is intended except as specifically noted.

B. Directed, Requested, Etc.: Where not otherwise explained, terms such as "directed", "requested", "authorized", "selected", "approved", "required", "accepted", and "permitted" mean "directed by the Architect/ Engineer", "requested by the Architect/ Engineer", and similar phrases. However, no such implied meaning will be interpreted to extend the Architect's/Engineer's responsibility into the Contractor's area of construction supervision.

C. Approve: Where used in conjunction with the Architect's/Engineer's response to submittals, requests, applications, inquiries, reports and claims by the Contractor, the meaning of the term "approved" will be held to limitations of the Architect's/Engineer's responsibilities and duties as specified in General and Supplementary Conditions. In no case will the Architect/Engineer's approval be interpreted as a release of the Contractor from responsibilities to fulfill requirements of Contract Documents.

D. Project Site: The term, "project site", is defined as the space available to the Contractor for performance of the Work, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings, and may or may not be identical with the description of the land upon which the Project is to be built.

E. Furnish: Except as otherwise defined in greater detail, the term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, and similar operations" as applicable in each instance.

F. Install: Except as otherwise defined in greater detail, the term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing protecting, cleaning and similar operations", as applicable in each instance.

G. Provide: Except as otherwise defined in greater detail, the term "provide" means "to furnish and install, complete and ready for intended use", as applicable in each instance.

H. Installer: The term "installer" is defined as "the entity" (person or firm) engaged by the Contractor, its subcontractor or sub-subcontractor for performance of a particular unit of work at the project site, including installation, erection, application and similar required operations. It is a requirement that installers are experienced in the operations they are engaged to perform.

I. Testing Laboratories: The term "testing laboratory" is defined as an independent entity engaged to perform specific inspections or tests of the Work, either at the project site or elsewhere, and to report, and (if required) interpret results of those inspections or tests.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Except where more explicit or more stringent requirements are written into the Contract Documents, applicable construction industry standards have the same force and effect as if bound into or copied directly into the Contract Documents. Such industry standards are made a part of the Contract Documents by reference. Individual specification sections indicate which codes and standards the Contractor must keep available at the project site for reference.

1. Referenced standards (standards referenced directly in the Contract Documents) take precedence over non-referenced standards that are recognized in the industry for applicability to the Work.
2. Non-referenced standards are defined as not being applicable to the Work, except as a general requirement of whether the Work complies with recognized construction industry standards.

B. Publication Dates: Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of date of Contract Documents.

C. Conflicting Requirements: Where compliance with two (2) or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents specifically indicate a less stringent requirement. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect/Engineer for a decision before proceeding.

1. Minimum Quantities or Quality Levels: In every instance the quantity or quality level shown or specified is intended to be the minimum for the work to be provided or performed. Unless otherwise indicated, the actual work may either comply exactly, within specified tolerances, with the minimum quantity or quality specified, or may exceed that minimum within reasonable limits. In complying with these requirements, the indicated numeric values are either minimum or maximum values, as notes, or as appropriate for the context of the requirements. Refer instances of uncertainty to the Architect/Engineer for decision before proceeding.

D. Copies of Standards: The Contract Documents require that each entity performing work be experienced in that part of the Work being performed. Each entity is also required to be familiar with industry standards applicable to that part of the work. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed for proper performance of the Work, the Contractor is required to obtain such copies directly from the publication source.
2. Although certain copies of standards needed for enforcement of the requirements may be required submittals, the Architect/ Engineer reserves the right to require the Contractor to submit additional copies of these standards as necessary for enforcement of the requirements.

1.5 SUBMITTALS

A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 014216

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SECTION 014533 – SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Special Inspection as defined in Chapter 17 of the Kentucky Building Code, and the 2012 International Building Code.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

C. The Owner will procure personnel to perform Special Inspections as specified. Special Inspector personnel shall be in addition to the quality control inspections and inspectors required elsewhere in other Specifications. Contractor shall coordinate Special Inspections as specified herein.

D. Special Inspection is required on the following structures:

1. Dudley Complex Sodium Hypochlorite Building

1.3 SUBMITTALS REQUIRED BY THE SPECIAL INSPECTOR

A. Overall:

1. Prepare and/or assemble and submit certifications:

a. Contractor’s Statement of Responsibility: Submit before the start of construction, acknowledging the following:

a) Awareness of the special requirements contained in the statement of special inspections.

b) Acknowledgement that control will be exercised by the contractor to ensure conformance with the construction documents.

c) Description of the procedures within the contractor's organization to exercise such control.

d) The method by and frequency of which reports are distributed to the persons in the contractor's organization exercising the control.

e) Identification and qualifications of the persons in the contractor's organization exercising such control and their positions within the organization.

b. Special Inspector's Qualifications: Submit before the start of construction.

c. Special Inspector's Final Certification: Submit after completion of inspections.

B. Fabricators:

1. Prepare and submit inspection reports:

a. Inspection of Fabricator's Quality Control Procedures

2. Prepare and submit certifications:

a. Quality Control Certification

b. Fabrication Quality Control Procedures

c. Fabricators Certificate of Compliance: stating that the work was performed in accordance with the approved construction documents (submitted at the completion of such work).

C. Soils Construction:

1. Prepare and submit test reports:

a. Soil bearing capacity at foundations.

b. Controlled fill density at controlled fill for the structure.

2. Prepare and submit inspection reports:

a. Inspection of Placement of Controlled Fill: Prior to each placement of footing concrete.

D. Concrete Construction:

1. Prepare and submit test reports:

a. Compressive strength, slump, and air content. Concrete shall be tested once per day that concrete is placed plus once for every 100 yards of concrete placed thereafter for each structure.

2. Prepare and submit inspection reports:

a. Inspection of forms, installation of reinforcement and delivery tickets prior to each placement of concrete.

3. Prepare and submit certifications:

a. Cement

b. Aggregate

c. Admixtures

d. Reinforcement

E. Masonry Construction:

1. Prepare and submit test reports:

a. Mortar aggregate ratio and mortar air content: Test each once at beginning of project and once for each 5,000 s.f. of masonry thereafter.

2. Prepare and submit inspection reports:

a. Inspection of mortar proportioning once at beginning of projects and once for each 5,000 s.f. of masonry thereafter.

b. Inspection of placement of masonry, reinforcement, and grout prior to and during each placement of grout.

3. Prepare and submit certifications:

a. Masonry Units

b. Cement for Mortar

c. Sand for Mortar

d. Grout

e. Reinforcement

F. Steel Construction:

1. Prepare and submit inspection reports:

a. Inspection of marking and connection details for all members and connections – verify all steel members are installed in the correct locations and are connected in accordance with the construction documents and approved erection drawings.

b. Inspection of bolt pretensioning for each applicable connection.

c. Visual inspection of all field welds.

2. Prepare and submit certifications:

a. Certified Mill Test Reports (MTRs) for steel, bolts, nuts, washers and weld filler metal (for field welds).

G. Wood Construction:

1. Prepare and submit inspection reports:

a. Inspection of markings, connection details, and assemblies for all members and connections.

PART 2 – PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 DUTIES AND RESPONSIBILITIES OF THE SPECIAL INSPECTOR

A. The Special Inspector shall observe the Work and perform tests to ensure conformance with the design drawings and specifications, and the applicable workmanship provisions of the Kentucky Building Code, and the 2012 International Building Code.

1. Approved shop drawings may be used only as an aid to inspection.
2. The Special Inspector shall observe activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
3. The Special Inspector shall submit timely inspection reports; weekly at a maximum.

B. The Special Inspector shall obtain from the contractor all certifications required to be submitted as part of the special inspection requirements (e.g. Contractor's Statement of Responsibility, Fabricators' Quality Control Plans, Material Certifications) and submit them along with the field inspections and tests that the Special Inspector performs. Special Inspection submittals by the Special Inspector include ***ALL*** items included above, not just the ones that the Special Inspector prepares.

C. The Special Inspector shall cooperate with the Contractor and provide timely service, keep records of all inspections and furnish them in a timely manner to the Engineer/Architect, and Contractor as construction progresses.

D. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If discrepancies are not corrected, the discrepancies shall be brought to the attention of the Engineer/Architect prior to the completion of that phase of work.

E. Inspection Reports shall include the following:

1. Name, address, and telephone number of Special Inspector performing the inspection and making the report.
2. Dates and locations of samples and tests or inspections, date of report.
3. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
4. Description of the Work, identification of products, Specification Section, tests, and inspection methods.
5. Complete test or inspection data.
6. Test and inspection results and an interpretation of test results.
7. Statement on condition of substrates and their acceptability for installation of the product.
8. Statement that products at site comply with requirements.
9. Comments on professional opinion on whether tested, inspected, or installed Work complies with the Contract Document requirements.
10. Statement whether conditions, products, and installation will affect warranty.
11. Other required items indicated in individual Specification Sections.

F. Special Inspector's Final Certificates shall state that all items requiring Special Inspection and Testing were fulfilled and are in conformance with the approved design and shop drawings, specifications, approved change orders, and the applicable provisions of the Kentucky Building Code.

1. Items that were not in conformance and any unresolved discrepancies shall be itemized in the report.
2. Final report shall be bound, divided by construction type, and in chronological order.
3. Final Report shall be prepared by, sealed, and signed by the Special Inspector.

3.2 DUTIES AND RESPONSIBILITIES OF THE CONTRACTOR

A. Notify the Special Inspector with adequate advance notice when construction is ready to be inspected.

B. Provide Special Inspector access to approved plans, shop drawings, and change orders at the jobsite.

C. Submit required certifications (e.g. Contractor's Statement of Responsibility, Fabricators' Quality Control Plans, Material Certifications) to Special Inspector.

D. Provide Special Inspector access to work, including equipment with operator when necessary. Access to equipment includes, but is not limited to, man lifts, excavation equipment, etc.

E. Provide samples of materials to be tested in required quantities.

F. Provide storage space for Structural Testing/Inspection Agency's exclusive use, such as for storing and curing concrete testing samples. If required by the Special Inspector, Contractor shall provide cure box with electricity, water, and blankets for curing concrete specimens.

G. Provide labor to assist the Structural Testing/Inspection Agency in performing tests/inspections.

H. Retain at the jobsite all Special Inspection records submitted by the Special Inspector and provide these records for review by the Engineer/Architect and Building Inspector upon request.

I. Maintain a discrepancy log on site. Log shall list each discrepancy documented by the Special Inspector, state the date of discovery and Special Inspector's report number. Provide room for the Special Inspector to sign and date when said discrepancy is corrected. No work containing discrepancy shall be covered prior to having reinspection and approval by the Special Inspector.

J. Cooperate with the Special Inspector, Engineer/Architect, and Building Inspector in resolving any Special Inspection related coordination or quality problems.

K. Resolve non-conforming work before additional work is done that would make it difficult to resolve non-conforming work.

L. Costs of additional retesting that are required due to non-conforming work may be charged to the Contractor.

M. Neither the observation of the Engineer/Architect in the administration of the contract, nor tests/inspections by the Testing/Inspection Agency, nor approvals by persons other than the Engineer/Architect shall relieve the Contractor from its obligation to perform the work in accordance with the Contract Documents.

END OF SECTION 014533

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SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

This section specifies administrative and procedural requirements for temporary services and facilities, including such items as temporary utility services, temporary construction and support facilities, and project security and protection.

A. Use Charges: No cost or usage charges for temporary services or facilities are chargeable to the Owner or Engineer. Cost or use charges for temporary services or facilities will not be accepted as a basis of claims for a change-order extra.

B. Temporary utility services required for use at the project site include but are not limited to the following:

1. Water service and distribution.
2. Temporary electric power and light.
3. Telephone service.
4. Storm and sanitary sewer.
5. Provide adequate utility capacity at each stage of construction. Prior to availability of temporary utilities at the site, provide trucked-in services for start-up of construction operations.
6. Obtain and pay for temporary easements required to bring temporary utilities to the project site, where the Owner's permanent easement cannot be utilized for that purpose.
7. High speed internet service.

C. Temporary construction and support facilities required for the project include but are not limited to the following:

1. Temporary heat.
2. Field offices and storage sheds.
3. Temporary roads and paving.
4. Sanitary facilities, including drinking water.
5. Dewatering facilities and drains.
6. Temporary enclosures.
7. Project identification, bulletin boards and signs.
8. Waste disposal services.
9. Construction aids and miscellaneous general services and facilities.
10. Alternate temporary services and facilities, equivalent to those specified, may be used, subject to acceptance by the Engineer.

D. Security and protection facilities and services required for the project include but are not limited to the following:

1. Environmental protection.
2. Alternate security and protection methods or facilities, equivalent to those specified, may be used, subject to acceptance by the Engineer.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-01 Specification sections, apply to the Work of this Section.

1.3 PROPERTY PROTECTION

A. Care is to be exercised by the Contractor in all phases of construction, to prevent damage and/or injury to the Owner's and/or other property. Payments for the repair and restoration are limited as set forth in the "Conflict With or Damage to Existing Utilities Facilities" of the Supplementary General Conditions.

B. All exposed existing piping must be immediately supported to prevent damage. Prior to completion of each day's work, such piping must be adequately covered by the Contractor and approved by the Owner's representative.

C. The Contractor shall avoid unnecessary injury to trees and shall remove only those authorized to be removed by written consent of the Owner. Fences, gates, and terrain damaged or disarranged by the Contractor's forces shall be immediately restored in their original condition or better.

1.4 CONSTRUCTION WARNING SIGNS

A. The Contractor shall provide construction warning signs for each location where it is working in the state highway right-of-way or in City or County streets. It will further provide flagmen as required and shall abide by all Department of Highways safety rules, including size, type and placement of construction signs. All signs shall be of professional quality.

1.5 ACCESS ROADWAYS

A. The Contractor shall construct all access roadways needed during construction, and the planned access roadways for the completed project. The Contractor shall maintain access roadways continuously during the construction period.

B. The Contractor shall maintain all existing roadways within the project site which are used for any purpose by its construction operations. The degree and frequency of maintenance shall be adequate to keep existing roadways in a condition at least equal to their condition prior to construction. Road maintenance shall include daily dust control and grading as necessary on all roads and sweeping of paved roads every other day.

1.6 RESPONSIBILITY FOR TRENCH SETTLEMENT

A. The Contractor shall be responsible for any settlement caused by the construction, that occurs within one (1) year after the final acceptance of this Contract by the Owner. Repair of any damage caused by settlement shall meet the approval of the Owner.

1.7 WASTE DISPOSAL

A. The Contractor shall dispose of waste, including hazardous waste, off-site in accordance with all applicable laws and regulations.

1.8 CONTRACTOR'S TRAILERS AND MATERIAL STORAGE

A. The location of the Contractor's and Subcontractor's office and work trailers and parking areas on the project site shall be subject to the Owner's approval.

B. The location of the Contractor's and Subcontractor's material storage yards on the project site shall be subject to the Owner's approval.

1.9 QUALITY ASSURANCE

A. Regulations: Comply with requirements of local laws and regulations governing construction and local industry standards, in the installation and maintenance of temporary services and facilities, including but not limited to the following:

1. Obtain all permits as required by governing authorities.
2. Obtain and pay for temporary easements required across property other than that of Owner.
3. Comply with applicable codes.

    a. In addition, comply with "Environmental Impact" commitments the Owner or previous Owners of the site may have made to secure approval to proceed with construction of the project.

B. Inspections: Inspect and test each service before placing temporary utilities in use. Arrange for required inspections and tests by governing authorities, and obtain required certifications and permits for use.

1.10 JOB CONDITIONS

A. General: Provide each temporary service and facility ready for use at each location when the service or facility is first needed to avoid delay in performance of the Work. Maintain, expand as required, and modify temporary services and facilities as needed throughout the progress of the Work. Do not remove until services or facilities are no longer needed, or are replaced by the authorized use of completed permanent facilities.

With the establishment of the job progress schedule, establish a schedule for the implementation and termination of service for each temporary utility. At the earliest feasible time, and when acceptable to the Owner and Engineer, change over from the use of temporary utility service to the use of the permanent service, to enable removal of the temporary utility and to eliminate possible interference with completion of the Work.

B. Conditions of Use: Operate temporary services and facilities in a safe and efficient manner. Do not overload temporary services or facilities, and do not permit them to interfere with the progress of the Work. Do not allow unsanitary conditions, public nuisances or hazardous conditions to develop or persist on the site.

1. Temporary Utilities: Do not permit the freezing of pipes, flooding or the contamination of water sources.
2. Temporary Construction and Support Facilities: Maintain temporary facilities in such a manner as to prevent discomfort to users. Take necessary fire prevention measures. Maintain temporary support facilities in a sanitary manner so as to avoid health problems and other deleterious effects.
3. Security and Protection: Maintain site security and protection facilities in a safe, lawful and publicly acceptable manner. Take necessary measures to prevent erosion of the site.

PART 2 - PRODUCTS

2.1 MATERIALS, EQUIPMENT AND SERVICES

A. General: Provide new materials and equipment for temporary services and facilities; used materials and equipment that are undamaged and in serviceable condition may be used, if acceptable to the Engineer. Provide only materials and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards.

B. Temporary Electricity:

1. Provide temporary electrical service for construction needs, power to all construction trailers, and for lighting and heating facilities, throughout construction period.
2. Service shall be adequate for construction use by all trades during construction period.
3. Contractor shall make all necessary arrangements with the power company to obtain this service. It shall furnish, erect, and maintain the service pole, wires, main switch, panelboards, outlets, lights and metering facilities as required by the power company and as necessary to provide electrical service throughout the construction site.
4. Contractor shall be responsible for payment of all monthly billing charges for temporary electric power. Contractor shall pay costs of equipment, materials, furnishing, installing, maintenance and removal of temporary electric service facilities.
5. Contractor shall pay costs of equipment, furnishing, installing, maintenance and removal of temporary service facilities.
6. Maintenance of temporary electric service shall be the sole responsibility of the General Contractor.

C. Temporary Lighting:

1. Furnish and install temporary lighting required for :

    a. Construction needs.
    b. Safe and adequate working conditions.
    c. Public Safety.
    d. Security lighting.
    e. Temporary office and storage area lighting.

2. As each building is enclosed, temporary lighting shall be furnished to provide not less than 10 foot-candles in all areas.
3. Service Periods:

    a. Security lighting: All hours of darkness.
    b. Safety lighting:
    c. Within construction area: All times that authorized personnel are present.
    d. Public areas: At all times.

4. Costs of installation and operation: Contractor shall pay all installation, maintenance and removal costs of temporary lighting.
5. Maintenance of temporary lighting service (replacement of bulbs, etc.) shall be the sole responsibility of the General Contractor.

D. Temporary Heating and Ventilating

1. Furnish and install temporary heat and ventilation in enclosed areas throughout construction period required to:

    a. Facilitate progress of work.
    b. Protect work and products against dampness and cold.
    c. Prevent moisture condensation on surfaces.
    d. Provide suitable ambient temperatures and humidity levels for installation and curing of materials.
    e. Provide adequate ventilation to meet health regulations for safe working environment.
    f. Heat and ventilate temporary field offices for Contractor and for Engineer, and other storage and construction buildings.
    g. Allow beneficial occupancy of project, or portion of project, prior to final completion, including air conditioning.

2. Temperatures required in buildings:

    a. Generally, 24 hours a day: Minimum 40 degrees F. (4.5 degrees C.).
    b. 24 hours a day during placing, setting and curing of cementitious materials: As required by specification section for each product.
    c. 24 hours a day, seven (7) days prior to, and during, placing of interior finishes; woodwork, flooring, painting and finishing: As required by specification section for each product.
    d. 24 hours a day after application of finishes, and until Substantial Completion: Minimum 70 degrees F. (21 degrees C.).
    e. Storage areas: As required by Specification Section for each product.

3. Ventilation Required:

    a. General: Prevent hazardous accumulations of dusts, fumes, mists, vapors or gases in areas occupied during construction.
    b. Provide local exhaust ventilation to prevent harmful dispersal of hazardous substances into atmosphere of occupied areas.

c. Dispose of exhaust materials in a manner that will not result in harmful exposure to persons.
d. Ventilate storage spaces containing hazardous or volatile materials.
e. Provide adequate ventilation for:

1) Curing installed materials.
2) Dispersal of humidity.
3) Ventilation of temporary sanitary facilities.

f. Duration of operation:

1) At all times personnel occupies an area subject to hazardous accumulations of harmful elements.
2) Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful elements.
3) For curing installed materials: As required by specification section for respective materials.
4) For humidity dispersal: As needed to provide suitable ambient conditions for work.

4. Contractor shall pay costs of installation, operation, maintenance and removal of temporary heat and ventilation.

E. Temporary Telephone and Fax Service:

1. Furnish and install temporary telephone service for construction needs throughout construction periods.
2. Pay costs for temporary telephone service including installation, maintenance, and removal.
3. Pay service costs for all local telephone service.
4. Pay costs of toll charges related to construction of the Project.
5. Do not use Owner's existing telephone system.

F. Temporary Water:

1. Contractor shall make its own arrangements at its own expense for obtaining the water supply necessary for construction purposes.
2. Contractor shall pay costs of the furnishing, maintaining and removing all temporary water service equipment, fixtures, hose, piping, etc.

G. Protection and Security:

1. Provide barricades, lanterns and other such signs and signals as may be necessary to warn of the dangers in connection with open excavation and obstructions.
2. Provide an adequate and approved system to secure the project area at all times, especially during non-construction periods; General Contractor shall be solely responsible for taking proper security measures.
3. Contractor shall pay all costs for protection and security systems.

H. Sanitary Facilities:

1. The Contractor shall furnish, install and maintain ample sanitary facilities for the workmen. As the needs arise, enclosed temporary toilets, in sufficient number, shall be placed as directed by the Engineer. Permanent toilets installed under this Contract shall not be used during construction. Drinking water shall be provided from a proven safe source so piped or transported as to be kept clean and fresh and served from single service containers of satisfactory types.

I. Temporary Protection:

1. Temporary Enclosures:

a. Furnish and install temporary enclosures at doorways, windows and other openings in exterior walls, as necessitated by weather and other conditions, and when required for the progress of the Work. Temporary doors shall be substantially built and hung, equipped with proper hinges, locks and other necessary hardware and shall be removed and reset whenever required to accommodate the work of other trades requiring their removal. All enclosures shall be maintained in good repair and removed when no longer needed. Door and window frames and sills shall be protected as necessary to prevent damage to items during construction.

2. Temporary Covering:

a. Provide substantial temporary wood covering over all floor openings for ducts, shafts, equipment, etc., using rough planking at least two (2) inches thick, cleated together and made sufficiently strong and put in place wherever required.

3. Temporary Railing:

a. Temporary railing shall be provided on stairs and around wells, pits and other locations where needed, to prevent accidents or injury to persons.

J. Contractor's Field Office:

1. Each Contractor shall establish and maintain a field office on his project and have available at the office a responsible representative who can officially receive instructions from the Engineer. The Contractor's Field Office shall be provided in accordance with Section 01 52 13.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire project adequately and result in minimum interference with the performance of the Work.

B. Relocate, modify and extend services and facilities as required during the course of work so as to accommodate the entire work of the Project.

3.2 REMOVAL

A. Completely remove temporary materials, equipment, and offices upon completion of construction.

B. Repair damage caused by installation, and restore to specified or original condition.

END OF SECTION 015000

SECTION 015213 - FIELD OFFICES

PART 1 - GENERAL

1.1 CONTRACTOR'S FIELD OFFICE

A. The Contractor shall establish and maintain a field office on this project and have available at the office a responsible representative who can officially receive communications from the Owner and the Engineer. The Contractor shall have one complete, up-to-date set of Drawings, Specifications and Contract Documents (including all Addenda and Change Orders) in this office at all times, available for reference at any time. The office shall be provided with telephone service, toilet facilities, light, air conditioning and heat; the cost of which shall be borne by the Contractor. Notices, instructions, orders, directions or other communications from the Engineer, left at this office, shall be considered as received by the Contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 015213

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SECTION 017329 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. Definition: "Cutting and patching" includes cutting into existing construction to provide for the installation or performance of other Work and subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting and patching" is performed for coordination of the work, to uncover work for access or inspection, to obtain samples for testing, to permit alterations to be performed or for other similar purposes upon written instructions of the Engineer.

C. Cutting and patching is performed during the manufacture of products, or during the initial fabrication. Erection or installation processes are not considered to be "cutting and patching" under this definition. Drilling of holes to install fasteners and similar operations are also not considered to be "cutting and patching".

D. "Cutting and Patching" includes removal and replacement of Work not conforming to requirements of the Contract Documents, removal and replacement of defective Work, and uncovering Work to provide for installation of ill-timed Work.

E. No Work shall be endangered by cutting or altering Work or any part of it.

1.2 RELATED DOCUMENTS

A. Drawing and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to Work of this Section.

1.3 SUBMITTALS

A. Prior to cutting which affects structural safety of Project, submit written notice to the Engineer, requesting consent to proceed with cutting, including:

1. Identification of Project.
2. Description of affected work.
3. Necessity for cutting.
4. Effect on structural integrity of Project.
5. Description of proposed work. Designate:

    a. Scope of cutting and patching.
    b. Trades to execute work.
    c. Products proposed to be used.
    d. Extent of refinishing.

6. Alternatives to cutting and patching.

B. Should conditions of work, or schedule, indicate change of materials or methods, submit written recommendation to the Engineer, including:

1. Conditions indicating change.
2. Recommendations for alternative materials or methods.
3. Submittals as required for Substitutions.

C. Submit written notice to the Engineer, designating time Work will be uncovered, to provide for observation.

1.4 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural Work in a manner that would result in a reduction of load-carrying capacity or of load-deflection ratio.

B. Operational and Safety Limitations: Do not cut and patch operational elements or safety related components in a manner that would result in a reduction of their capacity to perform in the manner intended, including energy performance, or that would result in increased maintenance, or decreased operational life or decreased energy.

PART 2 - PRODUCTS

2.1 MATERIALS

A. For replacement of work removed, comply with Specifications for type of work to be done.

PART 3 - EXECUTION

3.1 INSPECTION

A. Before cutting, examine the surfaces to be cut and patched and the conditions under which the Work is to be performed. If unsafe or otherwise unsatisfactory conditions are encountered, take corrective action before proceeding with the Work.

3.2 PREPARATION

A. Temporary Support: To prevent failure, provide temporary support of Work to be cut. Provide shoring, bracing and support as required to maintain structural integrity of project.

B. Protection: Protect other Work during cutting and patching to prevent damage. Provide protection from adverse weather conditions for that part of the project that may be exposed during cutting and patching operations. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas. Take precautions not to cut existing pipe, conduit or duct serving the building but scheduled to be relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching Work. Except as otherwise indicated or as approved by the Engineer, proceed with cutting and patching at the earliest feasible time and complete Work without delay.

B. Cutting: Cut the Work using methods that are least likely to damage work to be retained or adjoining Work. Where possible, review proposed procedures with the original installer; comply with original installer's recommendations.

1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut through concrete and masonry using a cutting machine such as a carborundum saw or core drill to insure a neat hole. Cut holes and slots neatly to size required with minimum disturbance of adjacent work. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces. Temporarily cover openings when not in use.
2. Comply with requirements of applicable sections of Division 2 where cutting and patching requires excavating and backfilling.
3. By-pass utility services such as pipe and conduit, before cutting, where such utility services are shown or required to be removed, relocated or abandoned. Cut-off conduit and pipe in wall or partitions to be removed. After by-pass and cutting, cap, valve or plug and seal tight remaining portion of pipe and conduit to prevent entrance of moisture or other foreign matter.

C. Patching: Patch with seams which are durable and as invisible as possible. Comply with specified tolerances for the Work.

1. Where feasible, inspect and test patched areas to demonstrate integrity of work.
2. Restore exposed finishes of patched areas and where necessary, extend finish restoration into retained adjoining Work in a manner which will eliminate evidence of patching and refinishing.
3. Execute fittings and adjustment of products to provide finished installations to comply with specified tolerances.
4. Restore work which has been cut or removed; install new products to provide completed work in accord with requirements of Contract Documents.
5. Refinish entire surfaces as necessary to provide an even finish.

    a. Continuous Surfaces: To nearest intersection.
    b. Assembly: Entire refinishing.

3.4 CLEANING

A. Thoroughly clean areas and spaces where Work is performed or used as access to work. Remove completely point, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 017329

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SECTION 017400 - CLEANING

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. Maintain premises free from accumulations of waste, debris, and rubbish.

B. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all exposed surfaces. Leave project clean and ready for occupancy.

1.2 RELATED DOCUMENTS

A. Cutting and Patching: Section 01 73 29.

B. Project Closeout: Section 01 77 00.

C. Cleaning for Specific Products of Work: Specification Section for that work.

1.3 SAFETY REQUIREMENTS

A. Hazards Control:

1. Store volatile wastes in covered metal containers, and remove from premises daily.
2. Prevent accumulation of wastes which create hazardous conditions.
3. Provide adequate ventilation during use of violative noxious substances.

B. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on project site.
2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
3. Do not dispose of wastes into streams or waterways.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.1 DURING CONSTRUCTION

A. Execute cleaning to ensure that building, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.

B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

C. At reasonable intervals during progress of work, clean site and public properties, and dispose of waste materials, debris and rubbish.

D. Provide on-site containers for collection of waste materials, debris and rubbish.

E. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.

F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

G. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

3.2 FINAL CLEANING

A. Employ experienced workmen, or professional cleaners, for final cleaning.

B. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.

C. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from sight-xposed interior or exterior finished surfaces; polish surfaces so designated to shine finish.

D. Repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.

E. Broom clean paved surfaces; rake clean other surfaces of grounds.

F. Maintain cleaning until project, or portion thereof, is occupied by Owner.

END OF SECTION 017400

SECTION 017700 - PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Liquidated Damages: Supplemental General Conditions

B. Cleaning: Section 017400.

C. Project Record Documents: Section 017839.

1.2 SUBSTANTIAL COMPLETION

A. In order to initiate project closeout procedures, the Contractor shall submit the following:

1. Written certification to Engineer that project is Substantially Complete.
2. List of major items to be completed or corrected.

B. Engineer will make an inspection within seven (7) days after receipt of certification, together with Owner's Representative.

C. Should Engineer consider that work is Substantially Complete:

1. Contractor shall prepare, and submit to Engineer, a list of items to be completed or corrected, as determined by the inspection.
2. Engineer will prepare and issue a Certificate of Substantial Completion, containing:

a. Date of Substantial Completion.
b. Contractor's list of items to be completed or corrected, verified and amended by Engineer.
c. The time within which Contractor shall complete or correct work of listed items.
d. Time and date Owner will assume possession of work or designated portion thereof.
e. Responsibilities of Owner and Contractor for:

1) Insurance
2) Utilities
3) Operation of Mechanical, Electrical, and Other Systems.
4) Maintenance and Cleaning.
5) Security.

f. Signatures of:

1) Engineer
2) Contractor
3) Owner

3. Owner occupancy of Project or Designated Portion of Project:

    a. Contractor shall:

        1) Obtain certificate of occupancy.
        2) Perform final cleaning in accordance with Section 017400.

    b. Owner will occupy Project, under provisions stated in Certificates of Substantial Completion.

4. Contractor: Complete work listed for completion or correction, within designated time.

D. Should Engineer consider that work is not Substantially Complete:

1. It shall immediately notify Contractor, in writing, stating reasons.
2. Contractor: Complete work, and send second written Engineer, certifying that Project, or designated portion of Project is substantially complete.
3. Engineer will reinspect work.

E. Should Engineer consider that work is still not finally complete:

1. It shall notify Contractor, in writing, stating reasons.
2. Contractor shall take immediate steps to remedy the stated deficiencies, and send third written notice to the Engineer certifying that the work is complete.
3. Engineer and Owner will reinspect work at Contractor's expense.

1.3 FINAL INSPECTION

A. Contractor shall submit written certification that:

1. Contract Documents have been reviewed.
2. Project has been inspected for compliance with Contract Documents.
3. Work has been completed in accordance with Contract Documents.
4. Equipment and systems have been tested in presence of Owner's Representative and are operational.
5. Project is completed, and ready for final inspection.

B. Engineer will make final inspection within seven (7) days after receipt of certification.

C. Should Engineer consider that work is finally complete in accordance with requirements of Contract Documents, it shall request Contractor to make Project Closeout submittals.

D. Should Engineer consider that work is not finally complete:

1. It shall notify Contractor in writing, stating reasons.
2. Contractor shall take immediate steps to remedy the stated deficiencies, and send second written notice to Engineer certifying that work is complete.
3. Engineer will reinspect work.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: To requirements of Section 017839.

B. Guarantees, Warranties and Bonds: To requirements of particular technical Specifications and Section 017834.

1.5 INSTRUCTION

A. Instruct Owner's personnel in operation of all systems, mechanical, electrical, and other equipment.

1.6 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit final applications in accordance with requirements of General Conditions.

1.7 FINAL CERTIFICATE FOR PAYMENT

A. Engineer will issue final certificate in accordance with provisions of general conditions.

B. Should final completion be materially delayed through no fault of Contractor, Engineer may issue a Semi-Final Certificate for Payment.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017700

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SECTION 017823 – OPERATIONS AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Compile product data and related information appropriate for Owner's maintenance and operation of equipment furnished under the Contract. Prepare operating and maintenance data as specified.

B. In addition to maintenance and operations data, the manufacturer's printed recommended installation practice shall also be included. If not part of the operations and maintenance manual, separate written installation instructions shall be provided, serving to assist the Contractor in equipment installation.

C. Related requirements specified elsewhere:

1. Shop Drawings, Product Data and Samples: 01 33 23.
2. Project Closeout: Section 01 77 00.
3. Project Record Documents: Section 01 78 39.
4. Warranties and Bonds: Section 01 78 34.

1.2 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel:

1. Trained and experienced in maintenance and operation of the described products.
2. Completely familiar with requirements of this Section.
3. Skilled as a technical writer to the extent required to communicate essential data.
4. Skilled as a draftsman competent to prepare required drawings.

1.3 SUBMITTAL SCHEDULE

A. Submit one (1) digital copy and one (1) printed copy of preliminary draft of proposed formats and outlines of contents prior to submittal of operation and maintenance data of equipment.

1. Engineer will review draft and return with comments.

B. Submit one (1) digital copy and one (1) printed copy of completed data for final review:

1. Prior to the completion of the Contract and before payment in excess of 90% of the total Contract amount is authorized.

C. Provide two (2) copies of approved completed O & M Manual in final form ten (10) days prior to final inspection or acceptance to the Owner.

D. Engineers copies for both review and final version shall be in electronic format. Owner shall receive an electronic version AND two (2) hard copies.

1.4 FORM OF SUBMITTALS

A. Prepare data in the form of an instructional manual for use by Owner's personnel.

B. Format:

1. Size: 8-1/2 in. x 11 in.
2. Paper: 20 pound minimum, white, for typed pages.
3. Text: Manufacturer's printed data, or neatly typewritten.
4. Photo copies must be clear and legible.
5. Drawings:

    a. Provide reinforced punched binder tab, bind in with text.
    b. Fold large drawings to the size of the text pages where feasible.
    c. For flow or piping diagrams that cannot be detailed on the standard size drawings, a larger, appropriate size drawing may be submitted and supplied in a properly marked map packet.

6. Provide fly-leaf for each separate product, or each piece of operating equipment.

    a. Provide typed description of product, and major component parts of equipment.
    b. Provide indexed tabs.

7. Cover: Identify each volume with types or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:

    a. Title of Project.
    b. Identity of separate structure as applicable.
    c. Identity of general subject matter covered in the manual.

C. Binders:

1. Commercial quality, durable and cleanable, 3-hole, 3" or 4" D-ring binders, with oil and moisture resistant hard covers.
2. When multiple binders are used, correlate the data into related consistent grouping.
3. Imprinted on the front cover and side of each binder shall be the name of the Plant, the Contract Number and Volume Number.
4. Binders shall be new and not recycled form a prior data manual.

D. Engineers copies for both review and final version shall be in electronic format. Owner shall receive an electronic version AND two (2) hard copies.

1.5 CONTENTS OF MANUAL

A. Table of Contents: Each item of equipment shall be placed in a logical sequential order, as listed or ordered in the Contract Documents.

B. Content, for each unit of equipment and system, as appropriate:

1. Process Description: Detailed description of the process and operation functions as applicable.
2. Component Instructions: Instructions for all components of the equipment whether manufactured by the supplier or not, including valves, controllers and other miscellaneous components.
3. Component Data: Description of unit and component parts.

    a. Function, normal operating characteristics, and limiting conditions.
    b. Performance curves, engineering data and tests.
    c. Complete nomenclature and commercial number of all replaceable parts.
    d. Exploded and/or sectional drawing views.
    e. Piping diagrams numbered to correspond to the installation.
    f. Equipment model number and serial number.

4. Control and Wiring Diagrams:

    a. Internal and external wiring diagrams numbered to correspond to the installation.
    b. Control circuit diagrams
    c. One line diagrams
    d. P&ID drawings
    e. As-installed control diagrams by controls supplier.

5. Operating procedures:

    a. Start-up, break-in, routine and normal operating instructions.
    b. Regulation, control, stopping, shutdown and emergency instructions.
    c. Summer and winter operating instructions.
    d. Special operating instructions.
    e. Description of sequence of operation by control supplier.

6. Maintenance Procedures:

    a. Routine operations.
    b. Guide to "trouble-shooting".
    c. Disassembly, repair and reassembly.
    d. Alignment, adjusting and checking.
    e. Equipment parts list.
    f. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.

        1. Predicted life of parts subject to wear.

    g. Local service center.

7. Lubrication and Service schedule.

    a. Preventative maintenance schedule.
    b. Component lubrication and servicing interval schedule.
    c. List of lubricants and/or filters required.

d. Lubrication and servicing procedures.

8. Recommended spare parts list and quantities.
9. Guide to "trouble-shooting".
10. Plant specific instructions:

    a. Each Contractor's coordination drawings.
    b. As-installed color coded piping diagrams.
    c. Detailed specific “Sequence of Operation” for the constructed plant or project.
    d. Charts of valve tag numbers, with the location and function of each valve.

11. Plant specific start-up and shut-down procedures.

12. Detailed instructions for emergency operation

13. Other data as required under pertinent sections of Specifications.

C. Content, for each electrical system, as appropriate:

1. Description of system and component parts.

    a. Function, normal operating characteristics, and limiting conditions.
    b. Performance curves, engineering data and tests.
    c. Complete nomenclature and commercial number of replacement parts.

2. Circuit directories of panel boards.

    a. Electrical service.
    b. Controls.
    c. Communications.

3. As-installed color-coded wiring diagrams.
4. Operating procedures:

    a. Routine and normal operating instructions.
    b. Sequences required.
    c. Special operating instructions.

5. Maintenance procedures:

    a. Routine operations.
    b. Guide to "trouble-shooting".
    c. Disassembly, repair and reassembly.
    d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.
7. List of original manufacturer's recommended spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

D. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.

E. Additional requirements for operating and maintenance data: The respective section of Specifications.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017823

MANUFACTURER SUBMITTALS/
OPERATION AND MAINTENANCE MANUAL REVIEW GUIDE

Equipment Items	Draft Submittal (1.03 A)	Final Submittal (1.03 B)	Format (1.04 B)	Binder (1.04 C)	Table of Contents (1.05 A)	Process Description (1.05 B.1)	Component Instructions (1.05 B.2)	Component Data (1.05 B.3)	Model/Serial Number (1.07 B.3.f)	Control & Wiring Diagrams (1.05 B.4)	Operating Procedures (1.05 B.5)	Maintenance Procedures (1.05 B.6)	Lubrication & Service Schedule (1.05 B.7)	Spare Parts List (1.07 B.8)	Troubleshooting Guide (1.07 B.9)	Plant Specific Instructions (1.07 B.10)	Start-up/Shut-Down (1.07 B.11)	Emergency Operation (1.07 B.12)	Comments

SECTION 017834 - WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. Compile specified warranties and bonds.

B. Compile specified service and maintenance contracts.

C. Co-execute submittals when so specified.

D. Review submittals to verify compliance with Contract Documents.

E. Submit to Engineer for review and transmittal to Owner. **Comply with provisions of Section 013323.**

1.2 RELATED DOCUMENTS

A. Bid Bond: Instructions to Bidders.

B. Performance and Payment Bonds: General Conditions and Supplemental General Conditions.

C. Guaranty: General Conditions and Supplemental General Conditions.

D. General Warranty of Construction: General Conditions.

E. Project Closeout: Section 01 77 00.

F. Warranties and Bonds required for specific products: As listed in technical specifications in these Contract Documents herein.

G. Provisions of Warranties and Bonds, Duration: Respective specification sections for particular products.

1.3 SUBMITTALS REQUIREMENTS

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.

B. Furnish two (2) original signed copies.

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product, equipment or work item.

2. Firm name, address and telephone number.
3. Scope
4. Date of beginning of warranty, bond or service and maintenance contract.
5. Duration of warranty, bond or service and maintenance contract.
6. Provide information for Owner's personnel:

    a. Proper procedure in case of failure.
    b. Instances which might affect the validity of warranty or bond.

7. Contractor name, address and telephone number.

1.4 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2 in. x 11 in., punch sheets for 3-ring binder.

    a. Fold larger sheets to fit into binders.

2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS." List:

    a. Title of Project
    b. Name of Contractor

C. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.

1.5 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during progress of construction:

1. Submit documents within 10 days after inspection and acceptance.

B. Otherwise make submittals within 10 days after date of substantial completion, prior to final request for payment.

C. For items of work, where acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing the date of acceptance as the start of the warranty period.

1.6 SUBMITTALS REQUIRED

A. Submit warranties, bonds, service and maintenance contracts as specified in the respective sections of the Specifications.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017834

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SECTION 017839 - PROJECT RECORD DOCUMENTS - WATER

PART 1 - GENERAL

1.1 MAINTENANCE OF DOCUMENTS

A. Maintain at job site, one copy of:

1. Contract Drawings
2. Specifications
3. Addenda
4. Reviewed Shop Drawings
5. Change Orders
6. Other Modifications to Contract

B. Store documents in approved location, apart from documents used for construction.

C. Provide files and racks for storage of documents.

D. Maintain documents in clean, dry, legible condition.

E. Do not use record documents for construction purposes.

F. Make documents available at all times for inspection by Engineer and Owner.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Shop Drawings, Product Data, and Samples: Section 01 33 23.

1.3 MARKING DEVICES

A. Provide colored pencil or felt-tip marking pen for all marking.

1.4 RECORDING

A. Label each document "PROJECT RECORD" in 2-inch high printed letters.

B. Keep record documents current.

C. Do not permanently conceal any work until required information has been recorded.

D. Contract Drawings: Legibly mark to record actual construction:

1. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.

2. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
3. Field changes of dimension and detail.
4. Changes made by Change Order or Field Order.
5. Details not on original Contract Drawings.

E. Specifications and Addenda: Legibly mark up each section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
2. Changes made by Change Order or Field Order.
3. Other matters not originally specified.

F. Shop Drawings: Maintain as record documents; legibly annotate shop drawings to record changes made after review. Coordinate and confirm with Engineer that electronic versions of all shop drawings have been provided to Engineer.

1.5 SUBMITTALS

A. At completion of project, deliver record documents to Engineer.

B. Accompany submittal with transmittal letter, in duplicate, containing:

1. Date.
2. Project Title and Number.
3. Contractor's Name and Address.
4. Title and Number of each Record Document.
5. Certification that each Document as Submitted is Complete and Accurate.
6. Signature of Contractor, or Its Authorized Representative.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017839

DIVISION 02

EXISTING CONDITIONS

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SECTION 024100 - DEMOLITION & SALVAGE

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required for demolition as shown on the Drawings and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork: Section 312000

1.3 PROCEDURE

A. The procedures proposed for the accomplishment of salvage and demolition work shall be submitted for review. The procedures shall provide for safe conduct of the work, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations.

B. It is the responsibility of the Contractor to visit the site to familiarize himself with the amount of Work that is included under this Section.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 DUST CONTROL

A. The amount of dust resulting from the demolition shall be controlled to prevent the spread of dust to occupied portions of the plant and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.

3.2 DISCONNECTION OF UTILITY SERVICES

A. Utilities shall be disconnected at the points indicated by the Owner or Engineer and left in a safe condition.

3.3 BURNING

A. The use of burning at the project site for the disposal of refuse and debris will not be permitted, unless authorized in writing by the Owner.

3.4 PROTECTION OF EXISTING WORK

A. Existing work to remain shall be protected from damage. Work damaged by the Contractor shall be repaired to match existing work.

3.5 BACKFILL OF STRUCTURES

A. The portion of the demolished structures remaining below grade shall be backfilled with concrete, masonry, etc., from the demolition or any backfill material which is acceptable to the Engineer. The top two (2) feet of the backfill shall be made up of topsoil and graded to match the existing ground. It shall be free of any of the demolition material. The entire backfill shall be compacted in such a manner as to prevent settlement.

B. It is the responsibility of the Contractor to dispose of all excess demolition material from the site as soon as practicable.

3.6 SALVAGE MATERIAL

A. All equipment, pumps, controls, valves, piping, etc., is the property of the Owner and care shall be taken in its removal so not to damage it in any way. Such salvage material shall be removed and delivered to the Owner to a site designated by him. The Owner has the right to refuse any salvage material, and in such cases it is the responsibility of the Contractor to dispose of the unwanted material.

END OF SECTION 024100

DIVISION 03

CONCRETE

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SECTION 033100 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all cast-in-place concrete as indicated on the Drawings and specified herein.

B. All concrete construction shall conform to all applicable requirements of ACI 301 (latest), Specifications for Structural Concrete for Buildings, except as modified by the supplemental requirements specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork: Section 312000

1.3 SUBMITTALS

The Contractor shall submit the following data for Engineer's review in accordance with Section 013323.

A. Concrete mixture proportions, test results and curves plotted to establish water-cementitious materials ratio.

B. Proposed mix designs and all necessary substantiating data used to establish the proposed mix designs.

C. Mix designs shall be submitted for all mixes proposed or required to be used, including all mixes containing admixtures.

D. A certified copy of the control records of the proposed production facility establishing the standard deviation as defined in Paragraph 4.2.3.2. of ACI 301.

E. Submit shop drawings as specified in ACI 301. Submit shop drawing showing the location of proposed construction and control joints separate from the steel reinforcement shop drawings.

1. Construction Joints
2. Control Joints
3. Steel Reinforcement

1.4 QUALITY ASSURANCE

The Contractor shall obtain and have available in the field office at all times, the following references:

A. ACI 301 Specifications for Structural Concrete for Buildings ACI 301 (latest Revision).

B. SP-15 (05) Field Reference Manual: Specifications for Structural Concrete for Buildings with selected ACI references.

Available from:

The American Concrete Institute
Publications Department
P.O. Box 9094
Farmington Hills, Michigan 48333-9094

C. Manual of Standard Practice - CRSI. (Latest Edition).

D. Placing Reinforcing Bars - CRSI (Latest Edition).

Available from:

Concrete Reinforcing Steel Institute
933 North Plum Grove Road
Schaumburg, Illinois 60173-4758

E. ACI 318-08 Building Code Requirements for Structural Concrete and Commentary.

F. ACI 347 Guide to Form Work for Concrete.

PART 2 - PRODUCTS

2.1 CLASSES OF CONCRETE AND USAGE

A. Structural concrete of the various classes required shall be proportioned by either Method 1 or Method 2 of ACI 301 to produce the following 28-day compressive strengths:

1. Concrete used for foundation construction or concrete exposed to cycles of freeze thaw:

a. 4,500 psi compressive for strength at 28 days.
b. Type I or II cement plus supplementary cementitious materials.
c. Max. water-cementitious materials ratio = 0.45.
d. Min. cement content = 584 lbs.
e. Nominal max. size coarse aggregate = No. 67 (3/4" max.) or No. 57 (1" max.). Walls with architectural treatment shall use No. 67 (3/4" max.).
f. Air content = 6% plus or minus 1% by volume.
g. Slump = 3" - 4" when tested in accordance with ASTM C 143/C 143M. Slump shall not exceed 8 inches when high-range water-reducers are used.

B. Type I or II cement conforming to ASTM C 150 shall be used in all structural concrete. Cement for exposed to view concrete shall have a uniform color classification.

C. Coarse aggregate for concrete shall be size No. 57, as specified in ASTM C 33 unless a smaller size aggregate is required to conform to provisions of Section 4.2.2.3 of ACI 301. Coarse aggregate shall conform to all requirements of ASTM C 33.

D. Manufactured sand shall not be used as fine aggregate in concrete.

2.2 ADMIXTURES

A. An air entraining admixture shall be used on all concrete exposed to freezing and thawing cycles. Product shall be MB-AE 90, MB-VR or Micro Air by BASF Construction Chemicals or approved equal. Certification attesting to the percent of effective solids and compliance of the material with ASTM C 260 shall be furnished, if requested.

B. Water-Reducing Admixture shall conform to ASTM C 494/C 494M Type A. Product shall be "Pozzolith" Series or "PolyHeed" Series by BASF Construction Chemicals or approved equal.

C. High-Range Water-Reducing Admixture shall conform to ASTM C 494/C 494M Type F. Product shall be Rheobuild 1000, "Glenium" Series or PS 1466 by BASF Construction Chemicals or approved equal.

D. Accelerating Admixture shall conform to ASTM C 494/C 494M Type C or E. Products shall be Pozzolith NC 534 or Pozzutec 20+ by BASF Construction Chemicals or approved equal.

E. Retarding Admixture shall conform to ASTM C 494/C 494M Type B or D. Product shall be "Pozzolith" Series or "DELVO" Series by BASF Construction Chemicals.

F. A water-reducing, set controlling admixture (nonlignin type) shall be used in all concrete. The admixture shall be a combination of polyhydroxylated polymers including catalysts and components to produce the required setting time based on job site conditions, specified early strength development, finishing characteristics required, and surface texture, as determined by the Engineer.

G. Certification shall be furnished attesting that the admixture exceeds the physical requirements of ASTM C 494, Type A, water-reducing and normal setting admixture, and when required, for ASTM C 494, Type D, water-reducing and retarding admixture when used with local materials with which the subject concrete is composed.

H. The admixture manufacturer, when requested, shall provide a qualified concrete technician employed by the manufacturer to assist in proportioning concrete for optimum use. It shall also be available when requested to advise on proper addition of the admixture to the concrete and on adjustment of the concrete mix proportions to meet changing job conditions.

I. The admixture shall conform to ASTM C494, except that the durability factor for concrete containing the admixture shall be at least 100 percent of control, the water content a maximum of 90 percent of control and length change shall not be greater than control, as defined in ASTM C 494.

J. Where the Contractor finds it impractical to employ fully the recommended procedures for hot weather concreting, the Engineer may at its discretion, require the use of a set retarding admixture for mass concrete 2.5 feet or more thick for all concrete whenever the temperature at the time concrete is cast exceeds 80°F. The admixture shall be selected by the Contractor subject to the review of the Engineer. The admixture and concrete containing the admixture shall meet all the requirements of these Specifications. Preliminary tests of this concrete shall be required at the Contractor's expense.

K. When more than one (1) admixture is used, all admixtures shall be compatible. They should preferably be by the same manufacturer.

L. Calcium chloride will not be permitted as an admixture in any concrete.

2.3 REINFORCEMENT

A. The minimum yield strength of the reinforcement shall be 60,000 pounds per square inch. Bar reinforcement shall conform to the requirements of ASTM A 615/A 615M. All bar reinforcement shall be deformed.

B. Wire-mesh reinforcement shall be continuous between expansion joints. Laps shall be at least one full mesh plus 2 inches, staggered to avoid continuous lap in either direction, and securely wired or clipped with standard clips.

C. Smooth dowels shall be plain steel bars conforming to ASTM A 615/A615M, Grade 60, or steel pipe conforming to ASTM A 120, Schedule 80. Pipe, if used, shall be closed flush at each end with mortar or metal or plastic cap. Dowels shall be installed at right angles to construction joints and expansion joints. Dowels shall be accurately aligned parallel to the finished surface, and shall be rigidly held in place and supported during placing of the concrete. One end of dowels shall be oiled or greased or dowels shall be coated with high density polyethylene with a minimum thickness of 14 mils.

D. Reinforcement supports and other accessories in contact with the forms for members which will be exposed to view in the finished work shall be of stainless steel or shall have approved high-density polyethylene tips so that the metal portion shall be at least one-quarter of an inch from the form or surface. Supports for reinforcement, when in contact with the ground or stone fill, shall be precast stone concrete blocks. Particular attention is directed to the requirement of Paragraph 3.3.2.4 of ACI Standard 301. These requirements apply to all reinforcement, whether in walls or other vertical elements, inclined elements or flatwork.

E. Particular care shall be taken to bend tie wire ends away from exposed faces of beams, slabs and columns. In no case shall ends of tie wires project toward or touch formwork.

2.4 OTHER MATERIALS

A. Anchorage items shall be of standard manufacture and of type required to engage with the anchors to be installed therein under other sections of the Specifications and shall be subject to approval by the Engineer.

1. Slots shall be galvanized dovetail-type as specified in Section "Masonry Work".
2. Inserts shall be malleable iron or steel, and of sturdy design adequate strength for the load to be carried. All inserts shall be galvanized. Adjustable wedge inserts shall have an integral loop or strap at the back, or shall be slotted to receive a special-headed bolt not smaller than 5/8-inch in diameter and of the required length and fitted with hexagonal nut. Other inserts shall be either threaded or slotted as required by their usage. Threaded inserts shall have integral lugs to prevent running.

B. Flashing reglets shall be as specified in Section 075300. Reglets shall be correctly placed into forms prior to placing concrete in formwork.

C. Premolded expansion-joint filler strips shall conform to ASTM D 1752 and shall be 3/8-inch thick unless otherwise shown.

D. Joint sealants shall conform to ANSI A 116.1. The following joint sealants are acceptable:

1. Colma by Sika Chemical Corporation
2. Hornflex by A.C. Horn, Inc.
3. Sonolastic by BASF Construction Chemicals.

E. Nonshrink grout shall be Embeco 885 grout by BASF Construction Chemicals, Euco Firmix grout by the Euclid Chemical Company, or approved equal. The approved product shall be delivered to the site of the Work in the original sealed containers, each bearing the trade name of the material and the name of the manufacturer.

F. Hardeners and dustproofers shall be colorless, aqueous solution of zinc or magnesium fluosilicate. Each gallon of solution used for the first application shall contain not less than one pound of crystals. Each gallon of solution used for subsequent application shall contain not less than two pounds of crystals. Materials shall be reviewed by the Engineer. Product shall be Lapidolith by BASF Construction Chemicals or approved equal.

G. Porous fill shall be crushed rock or gravel of such size that all will pass a 1-1/2 inch screen and not more than 5 percent will pass a No. 4 screen, free from earth clay or other foreign substances.

H. Waterstops: Waterstops shall be polyvinyl chloride, flat dumbbell shape (no center bulb), of size shown on Drawings, complete with fittings as required such as unions, vertical tees, vertical ells, flat crosses, flat ells, flat tees, etc. Waterstops shall be securely wired into place to maintain proper position during placement of fresh concrete, as shown on the Drawings. Care shall be taken in the installation of the waterstop and the placing of the concrete to avoid "folding" while concrete is being placed, and to prevent voids in the concrete surrounding the waterstop.

PART 3 - EXECUTION

3.1 FINISHES

A. Exposed to Public View Concrete Surfaces:

1. All concrete exposed to view in the completed structure shall be produced using materials and workmanship to such quality that only nominal finishing will be required. The provisions of paragraphs 6.2.2.1 and 6.3.6 of ACI 301 shall apply to all exterior exposed to public view concrete surfaces, including the outside surfaces of tanks.
2. Forms for exposed concrete surfaces shall be exterior grade, high-density overlay plywood, steel, or wood forms with smooth tempered hard-board form-liners.

3. Forms shall be coated with an approved release agent before initial pour and between subsequent pours, in accordance with the manufacturer's printed instructions. Form boards shall not be wet prior to placing concrete.
4. Recessed joints in concrete shall be formed using lacquer-coated wood battens or forms, milled to indicated profiles. Battens and corner strips shall be carefully inspected before concrete is placed and damaged pieces replaced.
5. Chamfer strips shall be one (1) inch radius with leg, polyvinyl chloride strips by Gateway Building Products, Saf-T-Grip Specialties Corp., Vinylex Corp., or equal.
6. Form panels shall be provided in the maximum sized practicable in order to minimize form joints. Wherever practicable, form joints shall occur at recessed joints. All form joints in exterior exposed to view surfaces shall be carefully caulked with an approved nonstaining caulking compound. Joints shall not be taped. Form oil or other material which will impart a stain to the concrete shall not be allowed to contact concrete surfaces.
7. Care shall be taken to prevent chipping of corners or other damage to concrete when forms are removed. Exposed corners and other surfaces which may be damaged by ensuing operations shall be protected from damage by boxing, corner boards or other approved means until construction is completed.
8. Form ties shall remain in the walls and shall be equipped with a waterseal to prevent passage of water through the walls. Minimum set back of form ties shall be 1-1/2 inches from faces of wall. The hole left by removal of tie ends shall be sealed and grouted in accordance with the procedure described hereinafter in Par. 3.01.F. Form ties will be permitted to fall within as-cast areas of architecturally treated wall surfaces; this does not apply to walls receiving decorative waterproof masonry coating.
9. All formed exposed to view concrete surfaces shall have a "smooth rubbed finish". Exterior vertical surfaces shall be rubbed to one foot below grade. Interior exposed to public view vertical surfaces of liquid containers shall be rubbed to one (1) foot below the minimum liquid level that will occur during normal operations.

B. All vertical surfaces in liquid containing structures shall have a "smooth form" finish.

1. All "smooth form" concrete vertical surfaces shall be a true plane within 1/4 inch in ten (10) feet as determined by a ten (10) foot straightedge placed anywhere on the surface in any direction. Abrupt irregularities shall not exceed 1/8 inch.

C. Basin, flume, conduit and tank floors shall have a "troweled" finish unless shown otherwise on Drawings.

D. Weirs and overflow surfaces shall be given a "troweled" finish.

E. Exterior platforms, steps and landings, shall be given a "broom" finish. "Broom" finish shall be applied to surfaces which have been steel-troweled to an even, smooth finish. The troweled surface shall then be broomed with a fiber-bristle brush in the direction transverse to that of the main traffic.

F. Patching of holes due to removal of tie ends and other repairable defective areas, shall be as follows: Entire contact area of hole shall be coated with two-part moisture insensitive epoxy bonding compound as specified in Par. 2.04.B. in accordance with manufacturer's specifications, and prior to placing of freshly mixed patching mortar. Parching mortar shall be mixed and placed in general accordance with ACI 301, Par. 5.3.7.5.

G. For floors and slabs in which drains occur, special care shall be exercised to slope the floors uniformly to the drains. All floors with drains shall be sloped not less than 1/8 inch per foot unless otherwise shown. In all areas where quarry tile or other materials requiring more than 1/4 inch drop are to be overlaid, the concrete base slab shall be depressed to provide a finished floor at the same elevation as surrounding areas.

3.2 TESTING

A. All testing shall be in accordance with provisions of ACI 301. Testing services listed in ACI Sections 1.6.4 shall be performed by a testing agency acceptable to the Engineer and Owner.

B. The testing services of ACI sections 1.6.4.2 and 1.6.4.3 shall be performed at the Contractor's expense. The Owner-approved third party testing agency shall be responsible for making concrete test cylinders, storing and protecting concrete cylinders and delivering cylinders to the Owner-approved testing laboratory.

C. Testing services of ACI Section 1.6.4.4 shall be paid for by the Contractor. Test shall be made for each 50 cubic yards of concrete and/or each day concrete is placed.

3.3 ADDITIONAL REQUIREMENTS

A. Unless otherwise directed by the Engineer, the vertical surfaces of footings shall be formed. Excavations and reinforcement for all footings shall have been inspected by the Engineer before any concrete is placed.

B. The installation of underground and embedded items shall be inspected before slabs are placed. Pipes and conduits shall be installed below the concrete unless otherwise indicated. Fill required to raise the subgrade shall be placed as specified in Section 312000 "Earthwork". Porous fill not less than 6 inches in compacted thickness shall be installed under all slabs, tank bottoms, and foundations. The fill shall be leveled and uniformly compacted to a reasonably true and even surface. The surfaces shall be clean, free from frost, ice, mud and water. Waterproof paper, polyethylene sheeting of nominal 4-mil minimum thickness, or polyethylene-coated burlap shall be laid over all surfaces receiving concrete.

C. Concrete shall be placed in layers not over 18 inches deep and each layer shall be compacted by mechanical internal-vibrating equipment supplemented by hand spading, rodding and tamping as directed. Vibrators shall not be inserted into lower courses that have begun to set.

D. Concrete Mixing

1. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M and furnish batch ticket information.

    a. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and deliver time to 60 minutes.

2. Project site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

    a. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at lease 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
    b. For mixer capacity larger than 1 cu. Yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd.
    c. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

E. If concrete is placed by pumping, no aluminum shall be used in any parts of the pumping system which contact or might contaminate the concrete. Aluminum chutes and conveyors shall not be used.

F. All concrete surfaces shall be moist cured by the application of absorptive mats or double thicknesses of fabric kept continuously wet. Forms shall be kept continuously wet. Use of other curing methods will not be permitted unless written authorization is received from the Engineer.

G. The unit of operation shall not exceed 30 feet for tank walls and walls exposed to weather, and 45 feet for other work in any horizontal direction and not less than 48 hours shall elapse between casting of adjoining units unless these requirements are waived by the Engineer. Provision shall be made for jointing successive units as indicated or required to be made at spacing of approximately 25 feet. Additional construction joints required to satisfy the 25 foot spacing shall be located by the Contractor subject to the review of the Engineer. The Contractor shall submit for review drawings separate from the steel reinforcing drawings, showing the location of all proposed construction joints. All construction joints shall be prepared for bonding by roughening the surface of the concrete in an acceptable manner which will expose the aggregate uniformly and will not leave laitance, loosened particles of aggregate or damaged concrete at the surface. Joints in walls and columns shall be maintained level. Concrete shall be placed in layers not over 18 inches deep and each layer shall be compacted by mechanical internal-vibrating equipment supplemented by hand spading, rodding and tamping as directed. Vibrators shall not be inserted into lower courses that have begun to set.

H. Formwork for beam soffits and slabs and other parts that support the weight of concrete, shall remain in place until the concrete has reached its specified 28-day strength, unless otherwise specified or permitted.

I. Concrete Walks and Curbs:

1. Subgrade shall be true and well compacted at the required grades. Spongy and otherwise unsuitable material shall have been removed and replaced with approved material. Concrete walks shall be placed upon porous fill covered with waterproof paper, polyethylene sheeting of nominal 4-mil minimum thickness or polyethylene-coated burlap.
2. Concrete walks shall be not less than 4 inches in thickness. Walks shall have contraction joints every 5 linear feet in each groove in the top surface of the slab to a depth of at least

one-fourth the slab thickness with a jointing tool. Transverse expansion joints shall be installed at all returns, driveways, and opposite expansion joints in adjacent curbs. Where curbs are not adjacent, transverse expansion joints shall be installed at intervals of approximately forty (40) feet. Sidewalks shall receive a "broomed" finish. Scoring shall be in a transverse direction. Edges of the sidewalks and joints shall be edged with a tool having a radius not greater than 1/6 inch. Sidewalks adjacent to curbs shall have a slope of 1/4 inch per foot toward the curb. Sidewalks not adjacent to curbs shall have a slope of 1/4 inch per foot. The surface of the concrete shall show no variation in cross section in excess of 1/4 inch in 5 feet. Concrete walks shall be reinforced with 6 x 6-W1.4xW1.4 welded wire reinforcement.

3. Concrete curbs shall be constructed to the section indicated on the Standard Detail, and all horizontal and vertical curves shall be incorporated as indicated or required. Forms shall be steel as approved by the Engineer. At the option of the Contractor, the curbs may be precast or cast-in-place. Cast-in-place curbs shall be divided into sections 8 to 10 feet in length using steel divider plates. The divider plates shall extend completely through the concrete and shall be removed. Precast curbs shall be cast in lengths of 4 to 5 feet. All exposed surfaces of concrete shall be finished smooth. All sharp edges and the edges of joints and divisions shall be tooled to 1/4 inch radius. Steel reinforcement shall be installed where the curb crosses pipe trenches or other insecure foundations. Such reinforcement shall consist of two (2) No. 4 deformed bars near the bottom of the curb and shall extend at least 24 inches beyond the insecure area. Transverse expansion joints shall be installed at all curb returns and at intervals of approximately 40 feet.

J. Column base plates, bearing plates for beams and similar structural members, machinery and equipment bases shall, after being plumbed and properly positioned, be provided with full bearing with nonshrink grout. Concrete surfaces shall be rough, clean, free of oil, grease, and laitance and shall be moistened thoroughly immediately before grout is placed. Metal surfaces shall be clean and free of oil, grease and rust. Mixing and placing shall be in conformance with the material manufacturer's printed instructions. After the grout has set, exposed surfaces shall be cut back one (1) inch and covered with a parge coat of mortar consisting of one (1) part Portland cement, two (2) parts sand and sufficient water to make the mixture placeable. Parge coat shall have a smooth dense finish. Exposed surfaces of grout and parge coat shall be water cured with wet burlap for seven (7) days.

K. Grout fill which is formed in place by using rotating equipment as a screen, such as clarifiers and similar types of equipment, shall be mixed in proportions and consistencies as required by the manufacturer or supplier of the equipment.

L. Watertightness:

1. The structures which are intended to contain liquids and/or will be subjected to exterior hydrostatic pressures shall be so constructed that, when completed and tested, there shall be no loss of water and no wet spots shall show.
2. Waterstops shall be placed in other locations as indicated on the Drawings and are required to assure the watertightness of the structure. Special shop fabricated ells, tees and crosses shall be provided at junctions. Waterstops shall be extended at least 6 inches beyond end of placement in order to provide splice length for subsequent placement. In slabs and tank bottoms, water stops shall be turned up to be made continuous with waterstops at bottom of walls or in walls.
5. Joints between pipe (except cast iron wall pipe) and cast-in-place concrete walls shall be sealed by means of a groove cast completely around the pipe; the groove shall be filled

with a quick setting hydraulic compound similar and equal to Waterplug as made by BASF Construction Chemicals mixed and applied in accordance with the manufacturer's instructions.

M. Unless otherwise shown or directed, all pumps, other equipment, and items such as lockers, motor control centers and the like, shall be installed on concrete bases. The bases shall be constructed to the dimensions shown on the plans or as required to meet plan elevations. Where no specific plan elevations are required, the bases shall be 6 inches thick and shall extend 3 inches outside the metal equipment base. In general, the concrete bases shall be placed up to 2 inches below the metal base. The equipment shall then be properly shimmied to grade and the 2- inch void filled with nonshrink grout.

N. Concrete which, in the opinion of the Architect-Engineer, has excessive honeycomb, aggregate pockets or depressions will be rejected and the Contractor shall, at its own expense, remove the entire section containing such defects and replace it with acceptable concrete.

O. All existing contact surfaces with new patch shall be coated with moisture insensitive epoxy bonding adhesive, Sikadur Hi-Mod, Concresive LPL Liquid by BASF Construction Chemicals, or approved equal. Patch shall consist of base pour of 4,000 psi structural concrete, then a topping of non-shrink natural aggregate grout, Masterflow 713, Sonogrout by BASF Construction Chemicals, or approved equal, mixed and placed in accordance with manufacturer's instructions, to the thicknesses shown on Drawings. Coat base pour with epoxy bonding adhesive prior to placing grout course.

END OF SECTION 033100

SECTION 034000 – PRECAST CONCRETE STRUCTURES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all precast concrete structures and accessories appurtenances as shown on the Drawings and specified herein.

B. Delegated Design: Design of precast concrete structures, including comprehensive engineering analysis by a qualified professional engineer, licensed in the state in which the project is location, using performance requirements and design criteria indicated.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Cast-in-Place Concrete: Section 033100

B. Access Hatches: Section 083110

1.3 SUBMITTALS

The Contractor shall submit the following data for Engineer's review in accordance with Section 013323.

A. Delegated Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data, calculations, and erection drawings signed and sealed by the qualified professional engineer responsible for their preparation.

B. Product Data: For each type of product indicated included but not limited to standard precast units, proprietary precast units, embedded items, and accessories.

C. Design Data: Submit calculations prepared under the direct supervision of a professional engineer supporting the structural design, including resistance to buoyancy with groundwater table to the top of the structure, resistance to uplift and resistance to wheel loads in accordance with requirements and references indicated. The calculations shall be sealed by a professional engineer licensed in the state in which the project is located.

D. Test Reports: Submit test reports for the following:

1. Material certifications and/or laboratory test reports, including mill tests and all other test data, for Portland cement, blended cement, pozzolans, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this Project.
2. Test reports showing that the mix has been successfully tested to produce concrete with the properties specified and will be suitable for the job conditions. Such tests may include compressive strength, flexural strength, plastic or hardened air content, freeze

thaw durability, abrasion and absorption. Clearly detail in the specifications special tests for precast concrete or cast-in items.

3. Sufficient documentation, when the use of self-consolidating concrete (SCC) is proposed, showing a minimum of 30-days production track records demonstrating that SCC is appropriate for casting of the product.
4. In-plant QA/QC inspection reports, upon the request of the Project Representative.

E. Shop Drawings: Submit shop drawings for standard precast units and custom-made precast units prepared under direct supervision of a professional engineer licensed in the state in which the project is located. Shop drawings shall include:

1. The criteria and loads used in the design of the precast components.
2. All materials used, their specifications and their design strengths.
3. Layout, piecemark, dimensions, reinforcing, and connection details of each precast member, including openings.
4. Details and instructions for lifting, rigging, erection, and installation of each precast component.
5. Lists and descriptions of all loose accessory materials supplied.
6. Instructions on secondary pours (in the field) when required.
7. Professional Engineer's seal.

F. Quality Control Procedures: Submit certificate from the NPCA QC Manual that the precast concrete structure manufacturer participates in their QA/QC program.

G. Manufacturer's Instructions.

1.4 QUALITY ASSURANCE

A. Manufacturer of precast concrete structures shall be quality certified by NCPA. Inspect manufacture of structures in accordance with ASTM C1037.

B. Installer of precast concrete structures shall have a record of at least three (3) years of successful installation of similar products on similar projects.

C. Inspection of earthwork, compaction and backfill shall be in accordance with the earthwork specifications in Division 31.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver precast units to the site in accordance with the delivery schedule to avoid excessive build-up of units in storage at the site. Upon delivery to the jobsite, all precast concrete units will be inspected by the Project Representative for quality and final acceptance.

B. Store units off the ground or in a manner that will minimize potential damage.

C. Handle, transport, and store products in a manner to minimize damage. Lifting devices or holes shall be consistent with industry standards. Perform lifting with methods or devices intended for this purpose as indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE STRUCTURES

A. Circular precast vaults and structures shall conform to ASTM C478. Non-circular vaults and structures shall conform to ASTM C857. Access hatch and pipe penetrations shall be cast in the top slab and/or sides as indicated on the drawings.

B. Manhole frames and covers shall have a clear opening of 22 inches and shall be made of cast iron conforming to ASTM A48/A48M Class 30. Casting shall be smooth, clean and free from blisters, blowholes and shrinkage. Castings shall be dipped twice in a preparation of asphalt or coal tar and oil applied at a temperature of not less than 144 degrees F and not more than 155 degrees F so as to form a tenacious coating.

C. Structural design of precast concrete structures is hereby delegated.

D. All precast concrete structures shall be designed to resist the lateral soil pressures and fluid pressures in accordance with ASTM C857.

E. All precast concrete structures have integral flanges at the base to engage enough soil resistance to resist the buoyant force from full submergence.

F. All precast concrete structures shall be designed to support HL-93 or HS25-44 wheel loads in accordance with the AASTHO HB-17 anywhere on the top surface of the structure.

G. Joints: Joints shall be watertight and shall be sealed with one of the following:

1. Rubber gaskets conforming to ASTM C443.
2. Pre-formed flexible butyl type joint sealant conforming to AASHTO M198.

    a. Hamilton Kent “Kent Seal No. 2”
    b. K.T. Snyder Company “Rub’r Nek”
    c. Press Seal Gasket “E Z Stik”

H. Corrosion Control: Follow recommendations outlined in ACPA 01-110 when hydrogen sulfide is indicated as a potential problem.

PART 3 - EXECUTION

3.1 FABRICATION

A. Fabricate precast concrete structures in accordance with NPCA QC Manual.

3.2 INSTALLATION

A. Install precast concrete structures in accordance with ASTM C891 and the manufacturer’s instructions.

B. Lift precast components at designated lifting points in accordance with the manufacturer's instructions and other applicable safety standards.

C. Precast concrete structures shall bear on a minimum 4 inch thick bedding / base / drainage course of free-draining granular material. See Division 31 for bedding / base / drainage course materials.

D. Do not bear precast concrete structures on uneven subgrade or grade with high points from rock pinnacles or boulders or rock ledges.

E. Install precast concrete structures in proper location, with the proper alignment and level.

F. Backfill around the precast concrete structures in accordance with Division 31 specifications.

3.3 JOINTS

A. Joints shall be sealed with an approved sealant as specified in Part 2, and shall be mortared or grouted.

B. When making joints with mastic compound prime and seal all joints with primer supplied with the joint compound.

C. Joints shall be watertight.

D. Pipe Connections into Precast Structures:

1. Precast Openings:

   a. Pipe shall be sealed in the precast section pipe opening with a resilient connector meeting the requirements of ASTM C923. Resilient connector shall be "Dura-Seal III" by Dura-Tech, Dayton, Ohio; "A-Lok" by A-LOK Products, Inc.; or approved equal.
   b. Resilient connector shall be cast integrally into the wall of the precast section at the time of manufacture. There shall be no mortar placed around the connector on the outside of the manhole and no mortar shall be placed around the top half of the connector on the inside of the manhole when completing the invert work.

2. Cored Openings:

   a. Pipe shall be sealed in cored precast section pipe opening with a resilient mechanical connector meeting the requirements of ASTM C923. Resilient connector shall be "NPC Kor-N-Seal I" (with stainless steel wedge) by Trelleborg Pipe Seals Milford, Inc.; "PSX: Direct Drive" by Press-Seal Gasket Corporations; interlocking link pipe seal; or approved equal. All fasteners and hardware shall be Type 304 stainless steel.
   b. There shall be no mortar placed around the connector on the outside of the structure and no mortar shall be placed around the top half of the connector on the inside of the structure when completing the invert work.

3.4 LEAKAGE TESTING

A. Leakage tests shall be made and observed by the Project Representative's representative for all precast structures. The test shall be the watertightness (exfiltration) test as described herein.

B. After each structure has been assembled in place, including wall piping, all lifting holds shall be filled with an approved non-shrink, non-metallic grout. Upon completion, each precast structure shall be tested to determine watertightness. The leakage test shall be made prior to placing any fill material and prior to application of interior/exterior wall coatings if specified. If the groundwater table has been allowed to rise above the bottom of the structure, it shall be lowered for the duration of the test. All pipes and other openings into the structures shall be suitably plugged and the plugs braced to prevent blow out.

C. The tank shall be filled with potable water to the maximum level. The test shall consist of measuring the liquid level over the next 24 hours to determine if any change has occurred. If a change is observed and exceeds the maximum allowance, the test shall be extended to a total of five days. If at the end of five days the average daily change has not exceeded the maximum allowance, the test shall be considered satisfactory.

D. The liquid volume loss for a period of 24 hours shall not exceed one-twentieth of one percent of the tank capacity, 0.0005 x tank volume. If the liquid volume loss exceeds this amount, it shall be considered excessive, and the tank shall be repaired and retested.

E. Damp spots will not be permitted at any location on the structure wall. Damp spots are defined as spots where moisture can be picked up on a dry hand. All such areas shall be repaired as necessary.

F. Damp spots or standing water on the footing may occur upon tank filling and are permissible within the allowable volume loss. Measurable flow in this area is not permissible and must be corrected.

G. It shall be the Contractor's responsibility to uncover the structure as necessary and to disassemble, reconstruct, or replace it as directed by the Project Representative. The structure shall then be retested.

H. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorptions, etc. It will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete. Furthermore, the Contractor shall take any steps necessary to assure the Project Representative that the water table is below the bottom of the structure throughout the test.

3.5 CLEAN UP

A. Upon completion of installation of the precast structures and appurtenances, the Contactor shall remove all debris and surplus construction materials resulting from the Work. The Contractor shall grade the ground around and adjacent to the construction area in a uniform and neat manner to the final grade lines.

END OF SECTION 034000

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DIVISION 04

MASONRY

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SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of each type of masonry work is indicated on drawings and in schedules.

B. Types of masonry work required include:

1. Reinforced concrete unit masonry.
2. Brick masonry, if shown or indicated.

1.3 QUALITY ASSURANCE

A. Fire Performance Characteristics: Where indicated, provide materials and construction which are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E 119 by a recognized testing and inspecting organization or by another means, as acceptable to authority having jurisdiction.

B. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

C. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

D. Mockups: Build sample panels for each type of exposed unit masonry assembly to verify selections made under sample Submittals and to demonstrate aesthetic effects.

1. Build mockups 48 inches long by 48 inches high by full thickness. Include corner condition. Mockup may be used in construction only with Engineer’s approval.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements.

B. Samples for initial selection purposes of the following:

1. Brick masonry samples in small-scale form showing full extent of colors and textures available for each different exposed masonry unit available.
2. Colored masonry mortar samples showing full extent of colors available.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry materials to project in undamaged condition.

B. Store and handle masonry units to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion or other causes.

C. Store cementitious materials off the ground, under cover and in dry location.

D. Store aggregates where grading and other required characteristics can be maintained.

E. Store masonry accessories including metal items to prevent deterioration by corrosion and accumulation of dirt.

1.6 PROJECT CONDITIONS

A. Protection of Work: During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

B. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

C. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.

D. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.

E. Staining: Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with such masonry.

F. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

G. Protect sills, ledges and projections from droppings of mortar.

H. Cold-Weather Requirements: Do not use frozen materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.

I. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.

1.7 ALLOWANCE

A. Include the cost of $650.00 per thousand for face brick as specified in paragraph 2.1 of this section. This cost shall include delivery, taxes, and unloading on the project site.

B. Coordinate materials and their installation with related materials and installation to ensure that the allowance item is completely integrated and interfaced with related construction activities.

PART 2 - PRODUCTS

2.1 BRICK MADE FROM CLAY OR SHALE

A. Size: Provide 2-1/4" x 3-3/4" x 8" facing bricks.

B. Provide special molded shapes where indicated and for application requiring brick of form, size and finish on exposed surfaces which cannot be produced from standard brick sizes by sawing.

C. For sills, caps and similar applications resulting in exposure of brick surfaces which otherwise would be concealed from view, provide uncored or unfrogged units with all exposed surfaces finished.

D. Facing Brick: ASTM C 216, Grade SW, type FBS with a compressive strength of 7500 psi, average, per ASTM C67. Color to uniform in color as selected from standard colors available.

2.2 CONCRETE MASONRY UNITS

A. General: Comply with referenced standards and other requirements indicated below applicable to each form of concrete masonry unit required. Provide special shapes where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions. Provide bullnose units for outside corners for interior partitions, unless otherwise indicated.

B. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength for exposed units and where indicated.

1. Available Products:

a. Addiment Incorporated; Block Plus W-10.
b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block.
c. Master Builders, Inc.; Rheopel.

C. Concrete Block: Provide units complying with characteristics indicated below for Grade, Type, face size, exposed face and, under each form of block included, for weight classification.

1. Grade N.
2. Size: Manufacturer's standard units with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual) x thickness indicated.
3. Type I, moisture-controlled units. Cure units by autoclave treatment at a minimum temperature of 350 degrees F (176 degrees C) and a minimum pressure of 125 psi.

4. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated. (Split-faced, Ground-face, etc.).
5. Hollow Loadbearing Block: ASTM C 90, normal weight.
6. Special Shapes: Provide normal weight or lightweight masonry units. Bullnose shape where indicated on drawings.
7. Concrete Building Brick: Provide units complying with ASTM C 55 and characteristics indicated below for grade, type, size and weight classification.

    a. Grade: Same as indicated for concrete block.
    b. Type: Same as indicated for concrete block.
    c. Size: Non-modular Standard 2-1/4"x3-3/4"x8".
    d. Weight Classification: Normal weight.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold weather construction. Provide natural color cement.

B. Hydrated Lime: ASTM C 207, Type S.

C. Aggregate for Mortar: ASTM C 144, except for joints less than 1/4" use aggregate graded with 100% passing the No. 16 sieve.

D. Water: Clean and potable.

E. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.

1. Available Products:

    a. Addiment Incorporated; Mortar Tite.
    b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
    c. Master Builders, Inc.; Rheomix Rheopel.

2.4 JOINT REINFORCEMENT, TIES AND ANCHORING DEVICES

A. Materials: Comply with requirements indicated below for basic materials and with requirements indicated under each form of joint reinforcement, tie and anchor for size and other characteristics:

1. Zinc-Coated (galvanized) Steel Wire: ASTM A 82 for uncoated wire and with ASTM C 641 for Class 3 (9.80 oz. per sq. ft. of wire surface). Use for masonry not exposed to exterior.
2. Hot-Dip Galvanized Steel Wire: ASTM A 82 for uncoated wire and with ASTM A 153, Class B-2 (1.5 oz. per sq. ft. of wire surface) for zinc coating applied after prefabrication into units. Use for masonry exposed to exterior and in contact with earth.
3. Zinc-Coated (Galvanized) Steel Sheet: Carbon steel with zinc coating complying with ASTM A 525, Coating Designation G90. Use for dovetail slots and where indicated.

4. Hot-Dip Galvanized Carbon Steel Sheet: ASTM A 366, Class 2 or ASTM A 635; hot-dip galvanized after fabrication to comply with ASTM A 153, Class B. Use for anchors.
5. Joint Reinforcement: Provide welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10', with prefabricated corner and tee units, and complying with requirements indicated below:

    a. Width: Fabricate joint reinforcement in units with widths of approximately 2" less than nominal width of walls and partitions as required to provide mortar coverage of not less than 5/8" on joint faces exposed to exterior and 1/2" elsewhere.
    b. Wire Size for Side Rods: 0.1875" diameter.
    c. Wire Size for Cross Rods: 0.1875" diameter.
    d. For multi-wythe masonry provide Truss design with diagonal cross rods spaced not more than 16" o.c. and having one side rod for each face shell of concrete masonry back-up and one rod for brick wythe.

6. Anchor Bolts: Provide steel bolts with hex nuts and flat washers complying with ASTM A 307, Grade A, hot-dip galvanized to comply with ASTM C 153, Class C, in sizes and configurations indicated.
7. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

    a. AA Wire Products Co.
    b. Dur-O-Wall, Inc.
    c. Heckman Building Products, Inc.
    d. Hohmann & Barnard, Inc.
    e. Masonry Reinforcing Corp. of America.
    f. National Wire Products Corp.

2.5 CONCEALED FLASHING MATERIALS

A. Laminated Flashing: Manufacturer's standard laminated flashing consisting of 7 oz. per sq. ft. copper sheet bonded with asphalt between 2 layers of glass fiber cloth.

B. Products: Subject to compliance with requirements, provide one of the following:

1. Copper Fabric Laminate Flashing:

    a. Copper Fabric; Afco Products, Inc.
    b. Copper Fabric Flashing; Sandell Mfg. Co., Inc.
    c. Copper Fabric Flashing; York Mfg., Inc.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Reinforcing Bars: Deformed steel, ASTM A 615, Grade 60 for bars No. 3 to No. 18.

B. Non-Metallic Expansion Joint Strips: Premolded, flexible cellular neoprene rubber filler strips complying with ASTM D 1056, Grade RE41E1, capable of compression up to 35%, of width and thickness indicated.

C. Premolded Control Joint Strips: Styrene-butadiene rubber compound complying with ASTM D 2000, Designation 2AA-805, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

D. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

E. Weep Holes: Provide round Plastic tubing, medium-density polyethylene, 3/8" outside diameter by CMU or brick width long. Space as indicated on drawings.

2.7 INSULATION

A. Extruded Polystyrene Board Insulation: Rigid cellular polystyrene thermal insulation with closed cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578, Type IV; 5-year aged r-value of 5 Btu/(hr x sf x degrees F) at 75 degrees F (24 degrees C); in manufacturer's standard lengths and widths; thickness as indicated. Subject to compliance with requirements, provide one of the following:

1. Dow Chemical USA: Styrofoam SM/SB.
2. UC Industries: Foamular 250.
3. Minnesota Diversified Products, Inc.: Certifoam.

B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.8 MASONRY CLEANER

A. Job-Mixed Detergent Solution: Solution of trisodium phosphate (1/2 cup dry measure) and laundry detergent (1/2 cup dry measure) dissolved in one gallon of water.

2.9 MORTAR AND GROUT MIXES

A. General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, anti-freeze compounds or other admixtures, unless otherwise indicated. Do not use calcium chloride in mortar or grout.

B. Mixing: Combine and thoroughly mix cementitious, water and aggregates in a mechanical batch mixer; comply with referenced ASTM standards for mixing time and water content.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for type of mortar required, unless otherwise indicated. Limit cementitious materials in mortar to portland cement-lime. Type S mortar for exterior, above-grade loadbearing and non-loadbearing walls; for interior loadbearing walls; and for other applications where another type is not indicated.

D. Grout for Unit Masonry: Comply with ASTM C 476 for grout for use in construction of reinforced and nonreinforced unit masonry. Use grout of consistency indicated or if not otherwise indicated, of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout. Use fine grout in grout spaces less than 2" in horizontal direction, unless otherwise indicated.

PART 3 – EXECUTION

3.1 INSTALLATION, GENERAL

A. Wetting Clay Brick: Wet brick made from clay or shale which have ASTM C 67 initial rates of absorption (suction) of more than 30 grams per 30 sq. in. per minute. Use wetting methods which ensure each clay masonry unit being nearly saturated but surface dry when laid.

B. Do not wet concrete masonry units.

C. Cleaning Reinforcing: Before placing, remove loose rust, ice and other coatings from reinforcing.

D. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.

E. Build chases and recesses as shown or required for the work of other trades. Provide not less than 8" of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.

F. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.

G. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining work. Use full-size units without cutting where possible. Use dry cutting saws to cut concrete masonry units.

3.2 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces of columns, walls and arrises do not exceed 1/4" in 10', or 3/8" in a story height not to exceed 20', nor 1/2" in 40' or more. For external corners, expansion joints, control joints and other conspicuous lines, do not exceed 1/4" in any story or 20' maximum, nor 1/2" in 40' or more. For vertical alignment of head joints do not exceed plus or minimum 1/4" in 10', 1/2" maximum.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4" in any bay or 20' maximum, nor 1/2" in 40' or more. For top surface of bearing walls do not exceed 1/8" between adjacent floor elements in 10' or 1/16" width of a single unit.

C. Variation of Linear Building Lines: For position shown in plan and related portion of columns, walls and partitions, do not exceed 1/2" in any bay or 20' maximum, nor 3/4" in 40' or more.

D. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions, shown, do not exceed minimum 1/4" nor plus 1/2".

E. Variation in Mortar Joint Thickness: Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8".

3.3 LAYING MASONRY WALLS

A. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to accurately locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and wherever possible at other locations.

B. Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.

C. Pattern Bond: Lay exposed masonry in the bond pattern shown or, if not shown, lay in running bond with vertical joint in each course centered on units in courses above and below. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2". Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4" horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Rack back 1/2-unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if required) and remove loose masonry units and mortar prior to laying fresh masonry.

E. Built-in Work: As the work progresses, build-in items specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core. Fill cores in hollow concrete masonry units with grout 3 courses (24") under bearing plates, beams, lintels, posts and similar items, unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay solid brick size masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.

B. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting courses on footings and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.

C. Set pre-cast concrete coping units in full bed of mortar with all vertical joints, slushed full. Fill dowel, anchor and similar holes solid. Rake head joints 1/2" to 3/4" and install elastomeric sealant and lead joint covers.

D. Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8" joints.

E. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials, unless otherwise indicated.

F. Tool exposed joints slightly concave using a jointer larger than joint thickness, unless otherwise indicated.

G. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

3.5 STRUCTURAL BONDING OF MULTI-WYTHE MASONRY

A. Use continuous horizontal joint reinforcement installed in horizontal mortar joints for bond tie between wythes. Install at not more than 16" o.c. vertically.

B. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.

C. For horizontally reinforced masonry, provide continuity at corners with prefabricated "L" units, in addition to masonry bonding.

D. Intersecting and Abutting walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes, provide continuity with horizontal joint reinforcement using prefabricated "T" units.

E. Non-bearing Interior Partitions: Build full height of story to underside of solid floor or roof structure above, unless otherwise shown. Wedge non-bearing partitions against structure above with small pieces of tile, slate or metal. Fill joint with mortar after dead load deflection of structure above approaches final position.

3.6 CAVITY WALLS

A. Keep cavity clean of mortar droppings and other materials during construction. Strike joints facing cavity flush.

B. Tie exterior wythe to back-up with continuous horizontal joint reinforcing, installed in mortar joints at not more than 16" o.c. vertically.

C. Provide weep holes in exterior wythe of cavity wall located immediately above ledges and flashing, spaced 2'-0" o.c., unless other wise indicated.

3.7 CAVITY WALL INSULATION

A. On units of plastic insulation, install small pads of adhesive spaced approximately 1'-0" o.c. both ways on inside face. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown. Fill all cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.8 HORIZONTAL JOINT REINFORCEMENT

A. General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls, 1/2" elsewhere. Lap reinforcing a minimum of 6". Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

B. Reinforce walls with continuous horizontal joint reinforcing unless specifically noted to be omitted.

C. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

D. Space continuous horizontal reinforcement for single wythe and multi-wythe walls at 16" o.c. vertically.

E. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcement placed in 2 horizontal joints approximately 8" apart, immediately above the lintel and immediately below the sill. Extend reinforcement a minimum of 2'-0" beyond jambs of the opening except at control joints.

3.9 ANCHORING MASONRY WORK

A. General: Provide anchor devices of type indicated.

B. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following: Provide an open space not less than 1" in width between masonry and structural member, rigid materials. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure. Space anchors as indicated, but not more than 24" o.c. vertically and 36" o.c. horizontally.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Provide vertical expansion, control and isolation joints in masonry every 20 feet or where shown. Build-in related items as the masonry work progresses. Build-in non-metallic joint fillers where indicated.

3.11 LINTELS

A. Install steel lintels where indicated. Provide masonry lintels where shown and wherever openings of more than 1'-0" for brick size units and 2'-0" for block size units are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Cure precast lintels before handling and installation. Temporarily support formed-in-place lintels. For hollow concrete masonry unit walls, use specially formed U-shaped lintel units with reinforcement bars placed as shown filled with coarse grout. Provide minimum bearing of 8" at each jamb, unless otherwise indicated.

3.12 FLASHING OF MASONRY WORK

A. General: Provide concealed flashing in masonry work at, or above, shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior. Prepare masonry surfaces smooth and free from projections which could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with mastic before covering with mortar. Extend flashings through exterior face of masonry and turn down to form drip.

B. Extend flashing the full length of lintels and shelf angles and minimum of 4" into masonry each end. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 8", and through the inner wythe to within 1/2" of the interior face of the wall in exposed work. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2". At heads and sills turn up ends not less than 2" to form a pan.

C. Provide weep holes in the head joints of the first course of masonry immediately above concealed flashings. Space 24" o.c., unless otherwise indicated.

D. Install reglets and nailers for flashing and other related work where shown to be built into masonry work.

E. Damp cure parging for at least 24 hours and protect until cured.

3.13 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants.

C. Final Cleaning: After mortar is thoroughly set and cured, clean masonry as follows: Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels. Protect adjacent concrete and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film or waterproof masking tape. Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water. Use bucket and brush hand cleaning method described in BIA "Technical Note No. 20 Revised" to clean brick masonry made from clay or shale. Clean concrete unit masonry to comply with masonry manufacturer's directions and applicable NCMA "Tek" bulletins.

D. Protection: Provide final protection and maintain conditions in a manner acceptable to Installer, which ensures unit masonry work being without damage and deterioration at time of substantial completion.

1. Water Protection: Water-repellant for all exposed brick masonry walls shall be as specified in Section 071900 - Water Repellants.

END OF SECTION 042000

DIVISION 05

METALS

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SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Field quality-control and special inspection reports.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172).

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint or to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

E. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.

3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992, Grade 50.

B. Plate and Bar, Angles: ASTM A 36, Grade 36.

C. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
4. Finish: Plain.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

1. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

D. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

2.6 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Galvanized surfaces.
4. Surfaces enclosed in interior construction.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.7 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels attached to structural-steel frame and located in exterior walls.

2.8 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

C. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

C. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

D. Splice members only where indicated.

E. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials.

3.5 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

D. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

END OF SECTION 051200

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DIVISION 06

WOOD, PLASTICS, AND COMPOSITES

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SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Wood blocking, cants, and nailers.
2. Plywood backing panels.
3. Misc. blocking and framing as shown or required.

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

1. Section 061600 "Sheathing."

1.3 DEFINITIONS

A. Rough carpentry includes carpentry work not specified as part of other Sections and generally not exposed, unless otherwise specified.

B. Exposed Framing: Framing not concealed by other construction.

C. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

D. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Shear panels.
5. Power-driven fasteners.
6. Powder-actuated fasteners.
7. Expansion anchors.
8. Metal framing anchors.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

A. Lumber Standards: Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

B. Inspection Agencies: Inspection agencies and the abbreviations used to reference them with lumber grades and species include the following:

1. SPIB - Southern Pine Inspection Bureau.

C. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1;

1. Use Category UC2 for interior construction not in contact with the ground.
2. Use Category UC3b for exterior construction not in contact with the ground.
3. Use Category UC4a for items in contact with the ground.
4. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood nailers, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat items indicated on Drawings, and the following:

1. Plywood backing panels.

2.4 DIMENSION LUMBER

A. For structural framing (2 to 4 inches thick, 5 inches and wider), provide the following grade and species:

1. "No. 2" grade.
2. Southern Pine graded under SPIB rules, or any species and grade that complies with the following requirements for species group as defined in Table 8.1a of N.F.P.A National Design Specification, for extreme fiber stress in bending "Fb" for single and repetitive members, and for modulus of elasticity "E":

a. Group II species, "Fb" of 1200 psi for single member use and of 1400 psi for repetitive member use, and "E" of 1,600,000 psi.

2.5 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction including rooftop equipment curbs and support bases, bucks, nailers, blocking, furring, grounds, stripping, and similar members.

B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

C. Moisture content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

D. Grade: "Standard" grade light-framing-size lumber of any species or board-size lumber as required

2.6 CONSTRUCTION PANELS, GENERAL

A. Construction Panel Standards: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood construction panels and, for products not manufactured under PS 1 provisions, with APA PRP-108.

B. Trademark: Furnish construction panels that are each factory-marked with APA trademark evidencing compliance with grade requirements.

2.7 CONSTRUCTION PANELS FOR BACKING

A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade designation, APA C-D PLUGGED EXPOSURE 1, in thickness indicated, or, if not otherwise indicated, not less than 15/32 inch.

2.8 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of AISI Type 304 stainless steel.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power Driven Fasteners: National Evaluation Report NER-272.

D. Wood Screws: ANSI B18.6.1.

E. Lag Bolts: ANSI B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers.

2.9 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.

B. Water Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbonate (IPBC) as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.

B. Set rough carpentry to required levels and lines, with members plumb and true to line and cut and fitted.

C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.

D. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

G. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

H. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with approved fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.

3.2 WOOD NAILERS, BLOCKING, AND SLEEPERS

A. Install wood nailers, blocking, and sleepers where shown and where required for attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

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SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof sheathing.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for plywood backing panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For following products, from ICC-ES:

1. Preservative-treated plywood.
2. Fire-retardant-treated plywood.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

2.2 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3b for exterior construction not in contact with the ground.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat all plywood unless otherwise indicated and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.

2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F (76 deg C) shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings, and the following:

1. Roof sheathing.

2.4 ROOF SHEATHING

A. Plywood Roof Sheathing: Exterior sheathing.

1. Nominal Thickness: Not less than 5/8 inch.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

A. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."

D. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Roof Sheathing:

a. Nail to wood framing.
b. Space panels 1/8 inch (3 mm) apart at edges and ends.

END OF SECTION 061600

SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wood roof trusses.

1.3 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
6. Show splice details and bearing details.

B. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation, registered in the state of West Virginia.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For metal connector-plate manufacturer, professional engineer, and fabricator.

B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.

C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.

D. Evaluation Reports: For the following, from ICC-ES:

1. Metal-plate connectors.
2. Metal truss accessories.

1.6 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that [participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
3. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.

B. Structural Performance: Metal-plate-connected wood trusses shall be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.

1. Design Loads: As indicated.
2. Maximum Deflection under Design Loads:

a. Roof Trusses: Vertical deflection of 1/240 of span for total load and l/480 of span for 100% live load.

C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.

D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Provide dressed lumber, S4S.
3. Provide dry lumber with 19 percent maximum moisture content at time of dressing.

B. Minimum Chord Size for Roof Trusses: 2 by 6 inches nominal for both top and bottom chords.

C. Minimum Specific Gravity for Top Chords: 0.50.

D. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061000 "Rough Carpentry.

2.3 METAL CONNECTOR PLATES

A. General: Fabricate connector plates to comply with TPI 1.

B. Hot-Dip Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 (Z180) coating designation; and not less than 0.036 inch (0.9 mm) thick.

1. Use for interior locations unless otherwise indicated.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.

B. Nails, Brads, and Staples: ASTM F 1667.

2.5 METAL FRAMING ANCHORS AND ACCESSORIES

A. Allowable design loads, as published by manufacturer, shall comply with or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

C. Truss Tie-Downs (Hurricane or Seismic Ties): Per truss supplier requirements.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 92 percent zinc dust by weight.

2.7 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.8 SOURCE QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.

1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the

workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.

2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.

B. Correct deficiencies in Work that special inspections indicate do not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

H. Securely connect each truss ply required for forming built-up girder trusses.

1. Anchor trusses to girder trusses as indicated.

I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

1. Install bracing to comply with Section 061000 "Rough Carpentry."

J. Install wood trusses within installation tolerances in TPI 1.

K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

L. Replace wood trusses that are damaged or do not comply with requirements.

1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIRS AND PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

C. Repair damaged galvanized coatings on exposed surfaces according to ASTM A 780/A 780M and manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections to verify that temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

END OF SECTION 061753

DIVISION 07

THERMAL AND MOISTURE PROTECTION

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SECTION 071113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Cold-applied cut-back asphalt dampproofing.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Section "Submittals."

1. Product Data: Include data substantiating that materials comply with specified requirements for each dampproofing material specified. A recommendation from the manufacturer of the product for the specific application.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed bituminous dampproofing work similar in material, design, and extent to that indicated for Project and that has resulted in construction with a record of successful in-service performance.

B. Single-Source Responsibility: Obtain primary dampproofing materials and primers from a single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1.5 PROJECT CONDITIONS

A. Substrate: Proceed with dampproofing work only after substrate construction and penetrating work have been completed.

B. Weather: Proceed with dampproofing work only when existing and forecast weather conditions will permit work to be performed in accordance with manufacturer's recommendations.

C. Ventilation: When application is adjacent to occupied spaces be prepared to provide adequate ventilation during application of solvent-based components. Maintain ventilation as

requested by the Owner until dampproofing membrane has thoroughly cured. Notify the Owner 48 hours in advance of the application.

PART 2 - PRODUCTS

2.1 BITUMINOUS DAMPPROOFING, GENERAL

A. Odor Elimination: For use adjacent to occupied spaces, provide type of bituminous dampproofing material that is warranted by manufacturer to be substantially odor-free after drying for 24 hours under normal conditions.

2.2 COLD-APPLIED CUT-BACK ASPHALT DAMPPROOFING

A. Asphalt and solvent compound mixed to a smooth, uniform consistency to provide a firm, moisture-resistant, vapor-resistant, elastic coating recommended by the manufacturer for dampproofing use when applied according to the manufacturer's instructions.

1. Provide nonfibrated-type liquid asbestos-free emulsion, spray grade; ASTM D 4479, Type I.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cut-back asphalt products that may be incorporated in the work include, but are not limited to, the following:

1. ChemRex, Inc./Sonneborne Building Products Div.
2. Karnak Chemical Corporation.
3. Meadows, W.R. Meadows, Inc.

2.3 MISCELLANEOUS MATERIALS

A. Protection Course, provide manufacturer's recommended required protection or a minimum of the following Film Type: 4-mil carbonated polyethylene film.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBSTRATE

A. Clean substrate of projections and substances detrimental to work, power wash if required; comply with recommendations of prime materials manufacturer.

B. Fill voids, seal joints, and apply bond breakers (if any) as recommended by prime materials manufacturer, with particular attention at construction joints.

C. Prime substrate as recommended by prime materials manufacturer.

D. Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and conductors. Prevent spillage and migration onto other surfaces of work, by masking or otherwise protecting adjoining work or plant material.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's recommendations, except where more stringent requirements are indicated or specified and where project conditions require extra precautions or provisions to ensure satisfactory performance of work.

3.3 BITUMINOUS DAMPPROOFING INSTALLATION

A. General: Apply dampproofing to footings and foundation walls where opposite side of wall faces occupied space.

B. Extend vertical dampproofing down walls from new finished grade line to existing grade line but do not extend onto surfaces that will be exposed to view when project is completed.

3.4 CUT-BACK ASPHALT ON EXTERIOR AND INTERIOR SURFACES

A. Apply coat of cold, liquid dampproofing material, by spraying at rate of 1. 5 to 2.5 gallons per 100 sq. ft., depending upon substrate texture, as required to produce a uniform dry film thickness of not less than 15 mils.

B. Apply a second coat same as specified above, after allowing 24 hours for drying of first coat. Apply second coat at rate of 1.5 to 2.5 gallons per 100 sq. ft. Double thickness of second coat where first application has failed to produce smooth, lustrous, impervious coat.

3.5 INSTALLATION OF DAMPPROOF PROTECTION COURSE

A. General: Follow manufacturer’s recommendations. Where indicated, install protection course of type indicated over completed-and-cured dampproofing treatment. Comply with dampproofing materials manufacturer's recommendations for method of support or attachment of protection materials. Support with spot application of plastic cement where not otherwise indicated.

END OF SECTION 071113

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SECTION 071900 - WATER REPELLENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes MPI-approved water-repellent treatments for the following vertical surfaces:

1. Clay brick masonry.

B. Related Sections:

1. Section 042000 "Unit Masonry" for integral water-repellent admixture for unit masonry assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Water repellents shall meet performance requirements indicated without failure due to defective manufacture, fabrication, or installation.

1. Water Repellents: Comply with performance requirements specified, as determined by testing on manufacturer's standard substrate assemblies representing those indicated for this Project.

B. Water Absorption: Minimum 80 percent reduction of water absorption after 24 hours in comparison of treated and untreated specimens.

1. Clay Brick: ASTM C 67.

C. Water-Vapor Transmission: Comply with one or both of the following:

1. Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, according to ASTM E 96/E 96M.
2. Minimum 80 percent water-vapor transmission in comparison of treated and untreated specimens, according to ASTM D 1653.

D. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, according to ASTM E 514.

E. Durability: Maximum 5 percent loss of water-repellent properties after 2500 hours of weathering according to ASTM G 154 in comparison to water-repellent-treated specimens before weathering.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include manufacturer's printed statement of VOC content.
2. Include manufacturer's standard colors.
3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.
4. Printout of current "MPI Approved Products List" for each product category specified in Part 2 that specifies water repellents approved by MPI, with the proposed product highlighted.

B. Samples: For each type of water repellent and substrate indicated, 12 by 12 inches (300 by 300 mm) in size, with specified water-repellent treatment applied to half of each Sample.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Applicator.

B. Product Certificates: For each type of water repellent, from manufacturer.

C. Preconstruction Testing Reports: For water-repellent-treated substrates.

D. Field quality-control reports.

E. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

B. MPI Standards: Comply with MPI standards indicated and provide water repellents listed in its "MPI Approved Products List."

C. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:

1. Concrete surfaces and mortar have cured for not less than 28 days.
2. Ambient temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C) and will remain so for 24 hours.
3. Substrate is not frozen and substrate-surface temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C).
4. Rain or snow is not predicted within 24 hours.
5. Not less than 24 hours have passed since surfaces were last wet.

6. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MPI-APPROVED WATER REPELLENTS

A. Water Repellent, Clear (Paintable); MPI #34: Penetrating, solvent-borne, clear water-repellent coating, for use on exterior masonry, brick, and concrete surfaces, and that can be recoated with conventional paints; often applied by flooding the surface under low-pressure spray.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Convenience Products: Seal-Krete – Original All Purpose Waterproofer.
b. Envirocoatings: Envirocoatings Sealbond.
c. Euclid Chemical: Tamms – Chemstop WB Regular.

2. VOC Content: 51 g/L or less.
3. MPI Green Performance Standard: GPS-1 and GPS-2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
2. Inspect for previously applied treatments that may inhibit penetration or performance of water repellents.
3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
4. Verify that required repairs are complete, cured, and dry before applying water repellent.

B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions and as follows:

1. Cast-in-Place Concrete and Concrete Unit Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents according to ASTM E 1857.
2. Clay Brick Masonry: Section 04012 "Maintenance of Unit Masonry.

B. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.

C. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

D. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply a heavy-saturation coating of water repellent, on surfaces indicated for treatment, using 15 psi- (103 kPa-) pressure spray with a fan-type spray nozzle to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

A. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:

1. Owner will engage the services of a qualified testing agency to sample water-repellent material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance of water-repellent material with product requirements.
3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor shall remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect.

B. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.

1. Notify Architect seven days in advance of the dates and times when surfaces will be tested.
2. Reapply water repellent until coverage test indicates complete coverage.

3.5 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071900

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SECTION 072100 – THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Foundation wall insulation (supporting backfill).
2. Concealed building insulation in board form.
3. Concealed building insulation in batt form.

1.3 DEFINITIONS

A. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by "r-values," they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Product data for each type of insulation product specified.

1.5 QUALITY ASSURANCE

A. Fire Performance Characteristics: Provide insulation materials identical to those whose indicated fire performance characteristics have been determined per the ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristic: ASTM E 84.
2. Fire Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

B. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to project site ahead of installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

C. Handle insulation boards carefully so corners are not broken off or the boards otherwise damaged.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering insulation products that may be incorporated in the work include, but are not limited to, the following:

1. Extruded Polystyrene Board Insulation:

a. DiversiFoam Products.
b. Dow: The Dow Chemical Company.
c. Owens Corning
d. UC Industries, Inc.

2. Glass-Blanket Fiber Insulation

a. CertainTeed Corporation.
b. Guardian Building Products, Inc.
c. Johns Manville.
d. Knauf Insulation.
e. Owens Corning.

2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.

B. Foundation / Cavity Wall Board Insulation – Extruded Polystyrene Board Insulation: Rigid, closed-cell extruded polystyrene thermal board insulation, complying with ASTM C 578-92; with 5-year aged r-values of 5.4 and 5 at 40 and 75 deg F (4.4 and 23.9 deg C), respectively; and as follows:

1. Type IV, 1.6 pcf min. density, compressive strength 25 psi.
2. Foundation Board Insulation Thickness: 1.5", unless otherwise indicated.
3. Cavity Wall Board Insulation Thickness: 1.5", unless otherwise indicated.

2.3 GLASS-FIBER BLANKET INSULATION

A. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

2.4 VAPOR RETARDERS

A. Exterior Wall Vapor Retarder – Polyethylene Vapor Retarder: ASTM D 4397, 6.0 mils thick, with a maximum permeance rating of 0.13 perms.

B. Tape for Vapor Retarder: Pressure sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

D. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

2.5 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation or mechanical anchors securely to substrates indicated without damaging or corroding either insulation, anchors, or substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions with Installer present, for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removal of projections that might puncture vapor retarders.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.

D. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF FOUNDATION PERIMETER BOARD INSULATION

A. Apply insulation boards to exterior surface of concrete foundation walls at building perimeter.

B. Set top of insulation boards 4 inches below finished grade, and extend down to 24 inches minimum below finish grade.

C. Set units in adhesive applied in accordance with manufacturer's instructions. Use type of adhesive recommended by insulation board manufacturer.

D. Backfill carefully to prevent damage to installed insulation board.

3.5 INSTALLATION OF PERIMETER WALL BOARD INSULATION

A. Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates indicated.

3.6 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

3.7 PROTECTION

A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

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SECTION 074113 - METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but is not limited to, the following:

1. Pre-formed metal roof panels.
2. Pre-finished built-in gutters, gutter-spouts, and fascia trim.
3. Flashing as required to waterproof the system (ridge, hip, valley, cleat, eave, peak, rake wall, rake edge, inside corner, outside corner, drip sill, penetrations, and other miscellaneous flashing).
4. Related accessories necessary for attachment of the roofing system.
5. All butyl tape and other sealants used in conjunction with the roofing system.
6. Other necessary hardware and accessories as may be required to meet the performance requirements of these specifications, and as required for a complete, watertight installation.

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

1. Division 4 Section “Unit Masonry” for through-wall flashing installed integrally with masonry work.
2. Division 6 Section “Sheathing”.
3. Division 7 Section "Sheet Metal Flashing and Trim" for field-formed fascia, copings, flashings, roof drainage systems, and other sheet metal work not part of metal roof panel assemblies.
4. Division 7 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.3 PERFORMANCE REQUIREMENTS

A. Wind-Uplift Resistance: Provide roof panel assemblies that meet requirements of UL 580 for Class 90 wind-uplift resistance.

B. Air Infiltration: Provide manufactured roof panel assemblies with permanent resistance to air leakage through assembly of not more than 0.014 cfm/sf of fixed roof area when tested in accordance with ASTM E 1680 at a static-air-pressure difference of 1.57 lbf/sf.

C. Thermal Performance: Provide manufactured roof panel assemblies capable of withstanding thermally induced movement without buckling, without producing excess stress on structure, anchors or facsteners, and without reducing performance ability or weathertightness.

1. Interface between panel and expansion clip shall provide for applicable thermal movement in each longitudinal direction.

D. Complete roof system, including all associated flashings, shall have no uncontrolled water penetration, other than condensation, when exposed to water at 6.24 psf differential static pressure when tested for not less than fifteen minutes in duration in accordance with ASTM E331-93 or ASTM E1646-95.

E. Entire roof system (metal panels, flashing, expansion joints, accessories, and penetrations) are to be designed and detailed by the manufacturer to provide a completely watertight roof under peak weather conditions. Roof Manufacturer shall notify the Architect in writing of any drawing, detail, or specification prepared by the Architect which, in the opinion of the Manufacturer, would result in a roof incapable of meeting this requirement. Manufacturer's failure to offer such written notification shall constitute Manufacturer's acceptance of the proposed drawings, details, and specifications.

F. Seam-Mounted Rail-Type Snow Guards: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data including manufacturer's product specifications, standard details, certified product test results, installation instructions, and general recommendations, as applicable to materials and finishes for each component and for total panel system.

C. Shop drawings of roof, rain drainage, edge details, ridge details, hip details, flashings, counterflashings, penetrations, and roof accessories. Show panel layouts and key all details. Draw layouts at ¼-inch scale, and details at 3-inch scale.

D. Information regarding ventilation capacities of manufacturer's proposed venting soffits and ridge vents, sufficient to allow Architect to verify compliance with Kentucky Building Code requirements.

E. Roof manufacturer shall provide written verification that the proposed roof insulation material installation provided under Division 7 Section "Thermal Insulation" is acceptable to the roof manufacturer as a roof substrate.

F. Roof manufacturer shall provide written verification that the proposed roof installer is an approved installer.

G. Samples for initial selection purposes in form of manufacturer's color charts or chips showing full range of colors, textures, and patterns available for roof and wall panels with factory-applied finishes.

H. Samples for verification purposes of roof panels. Provide sample panels 12 inches long by actual panel width, in the profile, style, color, and texture indicated. Include clips, battens, fasteners, closures, and other panel accessories.

I. Copy of proposed weathertightness and finish warranties.

1.5 QUALITY ASSURANCE

A. Installer: Engage an experienced installer who is familiar with installing products from the proposed roof system manufacturer.

1. Installer shall be a company authorized in writing by the roof system manufacturer to install the proposed roof system, and who has completed metal roof panel projects similar in material, design, and extent to that indicated for this Project.
2. Installer shall have a minimum 5-year record of successful in-service performance.
3. Installer shall be thoroughly trained and experienced in the necessary crafts, and shall be completely familiar with and comply to the recommendations and details of the manufacturer, and the "Architectural Sheet Metal Manual" published by SMACNA.
4. Installers shall follow the manufacturers' installation details without exception unless written authorization from the manufacturer and architect are provided on an installation detail revision. Detail revision authroization must be made in advance of product installation.

B. Roof Systems Manufacturer: Manufacturer shall be a company specializing in Architectural Sheet Metal Products with at least ten (10) years' experience. Being listed as a prequalified manufacturer does not release manufacturer from providing complete, current and acceptable test data for each performance, thermal and wind load requirements specified for specific proposed roof system.

1. Manufacturer shall operate a permanent, full-time, manufacturing facility where the metal roof panels are produced on fixed based roll-forming machines that are included in the Underwriter's Laboratory field inspection services. These facilities must be currently under yearly inspection by UL personnel to verify compliance that the products fabricated are in accordance with the specifications of the products which were originally tested.

C. Field Measurements: Where possible, prior to fabrication of panels, take field measurements of structure or substrates to receive panel system. Allow for trimming panel units where final dimensions cannot be established prior to fabrication.

D. All sheet metal shall be fabricated and installed in accordance with manufacturer's standards or SMACNA standards, whichever is more stringent.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver panels and other components so they will not be damaged or deformed. Package roof panels for protection against transportation and handling damage.

B. Handling: Exercise care in unloading, storing, and erecting wall and roof covering panels to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store panels so that they will not accumulate water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Components with strippable film shall not be stored in exposure to direct sunlight, unless otherwise approved by the Architect.

1.7 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Finish Warranty: Provide manufacturer's standard 20-year warranty, signed and executed to commence upon Substantial Completion, agreeing to repair or replace roof components that exhibit any of the following deteriorations to the factory-applied exterior finish:

1. Cracking, peeling, and loss of film integrity.
2. Fading or color change in excess of five (5) hunter delta E units as determined by ASTM D2244-79.
3. Chalking in excess of a numerical rating of eight (8) as determined by ASTM D4214-89.

C. Weathertightness: Provide manufacturer's written weathertightness warranty against leaks in the roof system arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions, and/or defective workmanship, equipment, or materials. Warranty shall be signed by both the metal roofing system manufacturer and the metal roofing system installer.

1. 10 Year – Shall be limited to the value of the installed metal roof assembly.
2. Warranty shall commence at the date of Substantial Completion.
3. Warranty shall not exclude any conditions such as edge flashings, valleys, hips, ridges, gutters, penetration flashings, etc. that are an integral part of the roof system.
4. The manufacturer of the metal roof system shall review installation details and perform on-site inspections as required to certify proper watertight roofing material installation.

D. Inspection and Report Services: Metal roof system manufacturer or its authorized agent shall perform an inspection of the entire roof system and shall submit a written report to the Owner detailing all conditions requiring maintenance and repair by parties under the above warranties. Inspections and reports shall be performed once every other year over the ten (10) year weathertightness warranty period. Cost of inspection and report service shall be included in the contract amount.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, provide metal roof system as supplied by one of the following:

1. AEP-Span
2. Architectural Metal Systems (AMS)
3. Centria
4. Dimensional Metals, Inc. (DMI)
5. Englert
6. Innovative Metals Co. (IMETCO)
7. Metal Building Components, Inc. (MBCI).
8. Metal Sales Manufacturing Corp.

2.2 SHEET MATERIALS

A. Commercial Quality Steel Sheet complying with ASTM A 792 with Galvalume coating conforming to ASTM A-792, unless otherwise approved by the Architect.

1. Provide 24 gage base material, unless otherwise shown or specified.

2.3 METAL FINISHES

A. General: Apply coatings either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Protect coating either by application of strippable film or by packing plastic film or other suitable material between panels in a manner to properly protect the finish. Furnish air-drying spray finish in matching color for touch-up.

1. Color: As selected by Architect from Manufacturer's full range. Match exterior of adjacent facility.

B. Fluoropolymer Coating: Kynar 500 or Hylar 5000, 70% resin by weight, with a total minimum dry film thickness of 1.0 mil and 30 percent reflective gloss when tested in accordance with ASTM D 523.

2.4 ROOF PANEL PRODUCT AND FABRICATION

A. General: Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as required to fulfill indicated performance requirements demonstrated by laboratory testing.

B. Details shown on drawings are based on "Span-Lock SL20" as manufactured by Dimensional Metals Inc. (DMI). Subject to compliance with requirements, equivalent products by other listed manufacturers are acceptable.

1. 24 gage base material, with integral standing seam (minimum 2.0" high)
2. Concealed clip, bearing plate & fasteners.
3. Panel profile:

    a. Building Roof Panel: "Striated Standard" profile.

4. 16" or 18" o.c. panel dimension, at Manufacturer's option.
5. Factory-applied non-curing seam sealant.

C. Standing seams shall incorporate a continuous mechanically seamed connection with concealed anchor clips that prevents the entrance of water passage, and shall include factory-applied non-curing seam sealant. Seams design shall utilize a capillary break to prevent siphoning.

D. Panels shall be continuous one-piece length from eave to ridge or hip. No end laps shall be allowed unless panel lengths exceed 65 ft., or as otherwise approved by the Architect.

1. Coordinate location of end laps with Architect prior to installation.

E. Fabricate panel joints in a manner that will minimize noise from movements within panel system.

2.5 THERMAL EXPANSION

A. Allowances for thermal expansion: Metal roofing system, including rain drainage, shall be deisgned, fabricated, and installed to allow relative movement between roof panels and fixed supports and ridges due to thermal expansion and contraction, given the locally occuring temperature extremes, without causing damage to the system or permanent deformation to any of the system components.

2.6 RAIN DRAINAGE

A. General: Provide gutters fabricated from 24 gauge roll-formed galvanized sheet steel, with finish and color to match roof panels. Cut edges shall be sealed and seamed. Include provisions for thermal movement in accordance with SMACNA requirements.

B. Gutters: Formed in sections not less than (20) feet in length, complete with end pieces, outlet tubes, and special pieces that may be required. Join sections with riveted and soldered or sealed joints. Unless otherwise indicated, provide expansion joint with cover plate spaced not more than 40 ft. o.c. (Show proposed locations on shop drawings.) Furnish gutter supports spaced at maximum 32" o.c., constructed of same metal as gutters. Provide aluminum, wire ball strainers at each outlet. Gutter size and configuration shall be as indicated on the drawings.

2.7 RAKE TRIM AND FASCIA TRIM

A. Provide rake trim, fascia trim, and related edge closures, as shown, and as required for a complete and watertight installation. Provide manufacturer's standard detail unless otherwise shown or specified.

B. Provide base material, finish and color of exposed surfaces to match roof panels.

2.8 FLASHING AND COUNTERFLASHING

A. Provide flashing and counterflashing as indicated, and as required for a complete and watertight installation.

B. Provide 24 gage material, with finish to match roof panels where exposed to view.

C. Fabricate roofing and related sheet metal work in accordance with approved shop drawings, and applicable standards set forth in the Sheet Metal and Air Conditioning Contractors National Association – Architectural Sheet Metal Manual (1987 Edition).

D. All sheet metal flashing and and related components shall be fabricated in minimum 10'-0" lengths except as noted otherwise. All flashing and trim shall have a minimum ½" hemmed edge in exposed locations. Provide field fabricated miters for components that change direction on the project.

2.9 UNDERLAYMENT MATERIALS

A. Felts: ASTM D226, Type II (No. 30), asphalt-saturated organic felts. (Note: At contractor's option, two layers of No. 15 felt may be used in lieu of No. 30 felt, subject to approval of the roof manufacturer. If two layers of #15 felt are used, then stagger joints in successive layers per roof manufacturer's recommendations.)

B. Ice and water shield: Min. 40 mil self-adhering polyethylene.

1. Product must be approved by the manufacturer for use over specified substrate.
2. Product must be approved by the manufacturer for use as an underlayment material for metal standing seam roof systems.
3. Product must be approved by the code authorities having jurisdiction.
4. Subject to compliance with requirements, provide "Ice & Water Shield" as manufactured by Grace, or "WeatherWatch" as manufactured by GAF.

2.10 RAIL-TYPE SNOW GUARDS

A. Seam-Mounted, Rail-Type Snow Guards:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Berger Bros. Co.
   b. LMCurbs
   c. S-5 Attachment Solutions; Metal Roof Innovations, Ltd.
   d. Sno-Gem, Inc.
   e. Snow Management Systems
   f. TRA SNOW AND SUN, INC.

2. Description: Snow guard rails fabricated from metal pipes or bars anchored to brackets and equipped with one rail.
3. Material and Finish: Aluminum; mill.

2.11 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.

1. Use stainless-steel fasteners for exterior applications, and galvanized steel fasteners for interior applications.
2. There shall be no exposed fasteners except to fasten flashing, at fixing points, or as otherwise indicated on the approved shop drawings.
3. Any fasteners (including screws or rivets) that are exposed to public view, as determined by the Architect, shall match the finish of the roof panel.

B. Accessories: Unless otherwise specified, provide components required for a complete watertight roof panel system, including trim, fascias, corner units, hip closures, ridge closures, clips, seam covers, battens, flashings, gutters, louvers, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.

1. Closure Strips: Closed-cell, self-extinguishing, expanded cellular rubber or cross-linked polyolefin foam flexible closure strips. Cut or premold to match configuration of roof and wall panels. Provide closure strips where indicated or necessary to ensure weathertight construction.
2. Factory-applied seam sealant: Unless otherwise recommended by the manufacturer, provide non-curing butyl designed for metal-to-metal connection in concealed joints.
3. Field-applied sealant: As recommended in writing by the metal roof system manufacturer.

2.12 PIPE FLASHING

A. General: Provide 'Deck-Mate' pipe flashing, or approved equal, to bend to contour of roof pitch. Size according to existing plumbing vents. Provide stainless steel clamps, neoprene gaskets, and non-curring sealant as shown on the architectural drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that work of other trades will not hamper or conflict with necessary fabrication and storage requirements for preformed metal roofing system.

B. Verify that work of other trades that penetrates roof, or is to be made watertight by roof, is coordinated by location, in place, and accepted prior to installation of roofing system.

C. Examine substrates and conditions, with Installer present, for compliance with requirements indicated for conditions affecting performance of metal panel roofing, and for compliance with manufacturer's substrate requirements. Do not proceed with roof panel installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate metal panel roofing with rain drainage work; flashing; trim; and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

B. Promptly remove protective film, if any, from exposed surfaces of metal panels. Strip with care to avoid damage to finish.

C. Do not overload roof or building structure with stored materials.

3.3 UNDERLAYMENT

A. Felt Underlayment: Except where ice & water shield is shown or required, install #30 unperforated felt underlayment over top of substrate. Install felt horizontally, starting at eave and working toward ridge, with 6" minimum overlap. Fasten as recommended by manufacturer and as required by building code. Ensure that all fasteners are secure, and flush with substrate.

B. Ice & Water Shield: Where shown, or where required for a watertight installation, provide specified ice and water shield membrane. Install membrane in accordance with membrance manufacturer's recommendations.

3.4 PANEL INSTALLATION

A. General: Comply with manufacturers' written instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the work securely in place, with provisions for thermal and structural movement.

1. Field cutting of exterior panels by torch is not permitted.
2. Install panels with concealed fasteners.

B. Accessories: Install components required for a complete roof panel system, including trim, fascias, snow guards, corner units, ridge closures, hip closures, clips, flashings, counterflashings, trim, gutters, downspouts, sealants, gaskets, fillers, closure strips, and similar items.

C. Joint Sealers: Install gaskets, joint fillers, and sealants where required for weatherproof performance of panel systems. Provide types of gaskets, sealants, and fillers of types recommended by panel manufacturer.

1. Flash and seal roof panels at eave and rake with rubber, neoprene, or other closures to exclude weather.

D. Standing Seam Roof Panel System: Fasten roof panels to supports with concealed clips in accordance with the manufacturer's instructions.

1. Tolerances: Maximum variation from true planes or lies shall be ¼" in 20'-0" or 3/8" in 40'-0", except where directly attributable to improper substrate conditions.
2. Provide manufacturer's standard hip closures that allow for expansion of the roof panels.

E. Install gutters and metal fascia trim in accordance with manufacturer's instructions. Match profile shown on drawings using manufacturer's closest equivalent.

1. Gutter design and installation shall comply with the provisions of the SMACNA Architectural Sheet Metal manual, including girth, thickness, and thermal expansion provisions.

F. Apply bituminous coating or other permanent separation materials on concealed panel surfaces where panels would otherwise be in direct contact with substrate materials that are noncompatible or could result in corrosion or deterioration of either material or finishes.

3.5 SNOW GUARD INSTALLATION

A. Install snow guards according to manufacturer's written instructions.

B. Attachment for Standing-Seam Metal Roofing:

1. Do not use fasteners that will penetrate metal roofing, or fastening methods that void metal roofing finish warranty.
2. Seam-Mounted, Rail-Type Snow Guards: Stainless-steel clamps attached to vertical ribs of standing-seam metal roof panels.

3.6 FLASHING AND TRIM

A. Coordinate flashing and sheet metal trimwork to provide watertight conditions at edges, saddles, ridges, valleys, rakes, and terminations. Fabricate and install in accordance with standards set forth in SMACNA Manual, using continuous cleats or other approved terminations.

B. Conceal fasteners and expansion provisions wherever possible.

C. Hem all exposed edges at least ½".

D. Terminate flashings and trim at reglets, termination bars, or other approved device.

E. Set flashing and trim level, true to line, and plumb.

3.7 MANUFACTURER'S FIELD SERVICES

A. Manufacturer's representative shall inspect the project during the installation process. Inspections shall be scheduled as required by the manufacturer of the roofing system, and coordinated with the Contractor and Installer.

B. At minimum, the following three visits are required:

1. Inspection of substrate and underlayment prior to starting installation.
2. Inspection of proper panel and flashing installation.
3. Final inspection upon completion of the metal roof system and accessores.

C. Upon final inspection, manufacturer shall issue a report to the Installer, with copy to the Contractor and Architect, detailing and descrepancies, and requirements for additional work. If additional work is required, then the manufacturer will provide another final inspection to verify acceptance of the completed work, and shall reissue the final report as outlined above.

3.8 CLEANING AND PROTECTION

A. Damaged Units: Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.

B. Cleaning: Remove temporary protective coverings and strippable films (if any) as soon as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer, and maintain in a clean condition during construction.

C. Prevent traffic on completed roof system.

END OF SECTION 074113

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following sheet metal fabrications:

1. Metal counter flashing and base flashing.
2. Miscellaneous sheet metal accessories as required for a complete project.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product. Include FM I-90 approval for coping system.

C. Letter from roofing system manufacturer (specified elsewhere in Division 7) accepting proposed sheet metal products, fabrication, and installation methods for incorporation into overall roof system warranty.

D. Samples of the following flashing, sheet metal, and accessory items:

1. 8-inch-square samples of specified sheet materials to be exposed as finished surfaces.

E. Shop drawings showing layout, profiles, methods of joining, and anchorages details, including major counterflashings. Provide layouts at 1/4-inch scale and details at 3-inch scale. Include proposed seam details, including expansion provisions.

1.4 PROJECT CONDITIONS

A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

1.5 QUALITY ASSURANCE

A. Sheet metal work specified under this Section shall be subject to the review and approval of the roof system manufacturer, since work of this Section is required to be incorporated into overall roof system warranty. Coordinate requirements with roof system supplier.

PART 2 - PRODUCTS

2.1 SHEET MATERIALS

A. Unless otherwise indicated, provide commercial quality steel sheet complying with ASTM A 792 with Galvalume coating conforming to ASTM A-792, unless otherwise approved by the Architect. Provide 24 gage, except as otherwise indicated.

2.2 METAL FINISHES

A. General: Apply coatings either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Protect coating as required during shipment and storage. Furnish air-drying spray finish in matching color for touch-up.

1. Color: As selected by the Architect from the manufacturer's standard colors. Match adjacent facility.

B. Fluoropolymer Coating: Kynar 500, 70% resin by weight, with a total minimum dry film thickness of 0.9 mil and 30 percent reflective gloss when tested in accordance with ASTM D 523.

1. Durability: Provide coating field tested under normal range of weathering conditions for minimum of 20 years without significant peel, blister, flake, chip, crack, or check in finish; without chalking in excess of No. 8 in accordance with ASTM D 4214; and without fading in excess of 5 Hunter units.

2.3 MISCELLANEOUS MATERIALS AND ACCESSORIES:

A. Solder: For use with steel or copper, provide 50 - 50 tin/lead solder (ASTM B 32), with rosin flux.

B. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

C. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

2.4 FABRICATION - GENERAL

A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual", "Roofing and Waterproofing Manual" by NRCA, roofing system manufacturer, and other recognized industry practices. Notify Architect if any details shown are in conflict with the various publications noted above.

1. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work.
2. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
3. Provide flanges for stripping into roofing work where so indicated or required for proper installation.
4. Prefabricate units as indicated, or provide standard manufactured units complying with requirements. Fabricate from sheet metal indicated or, if not otherwise indicated, from 24 gage prefinished galvanized steel.

B. Seams: For non-moving joints, fabricate seams with riveted and sealed joints and seams, unless otherwise recommended by manufacturer

C. Expansion Provisions: Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints). Other expansion provision configurations will be considered by the Architect upon recommendation by the sheet metal fabricator and concurrence of the roofing manufacturer. Spacing of expansion provisions shall not exceed 25 ft. o.c. or as recommended by SMACNA, whichever is less.

D. Sealant Joints: Where movable, nonexpansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

E. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. General: Except as otherwise indicated, comply with details shown, manufacturer's installation instructions and recommendations, "Roofing and Waterproofing Manual" by NRCA, and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

3.2 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Protection: Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

END OF SECTION 076200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes joint sealants for the following locations:

1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below:

a. Control joints in unit masonry.
b. Perimeter joints between unit masonry and frames of doors and windows.
c. Other joints as indicated.

2. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:

a. Perimeter joints of door and window openings.
b. Other joints as indicated.

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

1. Refer to other Division 7 Sections for sealants provided and installed as part of roofing work.
2. Refer to Divisions 21 - 28 for joint sealers in mechanical and electrical work; not work of this section.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data from manufacturers for each joint sealants product required. Include test reports for each type of sealant indicated; evidencing compliance with requirements specified.

C. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
2. When joint substrates are wet.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors: Provide color of exposed joint sealants to comply with the following:

1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

2.2 PRODUCTS

A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Subject to compliance with requirements, manufacturers producing elastometric sealants that may be incorporated in the Work, include, but are not limited to:

1. Sonneborn
2. Dow Corning
3. Thiokol
4. W.R. Meadows

C. General exterior non-traffic applications:

1. Standards: ASTM C-920
2. Type: One-component moisture curing, urethane sealant.
3. Color: As selected by Architect for each application.
4. Product: Sonneborn NP-1 or equal.

D. General interior applications:

1. Type: One-component, gun grade, paintable, acrylic latex caulk.
2. Color: As selected by Architect for each application.
3. Product: Sonneborn “Sonolac” or equal

E. Joints in ‘wet’ areas: Provide Sonneborn “Omniplus” or equal.

2.3 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Provide joint filler material as recommended by sealant manufacturer for application and sealant type indicated.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from joint sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean concrete, masonry, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to

produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Clean metal, glass, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962, or more current standard (if any), for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Solvent-Release-Curing Sealant Installation Standard: Comply with requirements of ASTM C 804, or more current standard (if any), for use of solvent-release-curing sealants.

D. Latex Sealant Installation Standard: Comply with requirements of ASTM C 90, or more current standard (if any), for use of latex sealants.

E. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

    a. Do not leave gaps between ends of joint fillers.
    b. Do not stretch, twist, puncture, or tear joint fillers.
    c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.

2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.

F. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint

configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

G. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

DIVISION 08

OPENINGS

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SECTION 082200 - FIBERGLASS REINFORCED PLASTIC (FRP) DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fiberglass Reinforced Plastic (FRP) Doors and Frames as indicated on Drawings.

B. Related Sections:

1. See Division 4 “Unit Masonry”.
2. See Division 8 “Door Hardware”.
3. See Division 8 “Glazing”.

1.3 SUBMITTALS

A. Shop Drawings: Include the following:

1. Summary door schedule indicating the specific reference numbers as used on drawings, with columns noting door type, frame type, size, handing, accessories and hardware.
2. A drawing depicting front and rear door elevations showing hardware.
3. Locations of reinforcement and preparations for hardware.
4. Details of each different wall opening condition.
5. Drawing showing dimensional location of each hardware item and size of each door.
6. Details of moldings, removable stops, and glazing.
7. Construction and mounting detail for each frame type.

B. Samples for Initial Selection: For factory-applied color finishes. Provide color samples of the actual finish material, not paper color charts.

1. Colors shall be chosen from manufacturer's full-range of available colors.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of fiberglass reinforced plastic door and frame assembly.

D. Product Technical Data Including:

1. Acknowledgment that products submitted meet requirements of standards referenced. Coordinate with door hardware schedule.
2. Manufacturer shall provide certificate of compliance with current local and federal regulations as it applies to the manufacturing process.

3. Manufacturer's installation instructions.
4. Schedule of doors and frames indicating the specific reference numbers as used on drawings, door type, frame type, size, handing and applicable hardware.
5. Details of core and edge construction. Include factory-construction specifications.
6. Certification of manufacturer's qualifications.
7. Fire-resistance ratings.

E. Operation and Maintenance Manuals:

1. Include recommended methods and frequency for maintaining optimum condition of fiberglass doors and frames under anticipated traffic and use conditions.
2. Include one set of final as built drawings with the same requirements as mentioned in Section A, above.
3. Include certificate of warranty for door and frame listing specific door registration numbers.
4. Include hardware data sheets and hardware manufacturer's warranties.

1.4 QUALITY ASSURANCE

A. Provide manufacturer’s heavy-duty doors and frames only. No light-duty, or medium-duty doors and frames will be accepted.

B. Source Limitations:

1. Manufacturer Qualifications: A company specialized in the manufacture of fiberglass reinforced plastic (FRP) doors and frames as specified herein with a minimum of (5) years documented experience and with a record of successful in-service performance for the applications as required for this project.
2. Installer Qualifications: An experienced installer who has completed fiberglass door and frame installations similar in material, design, and extent to those indicated and whose work has resulted in construction with a record of successful in-service performance.
3. Source Limitations: Obtain FRP doors and frames through one source fabricated from a single manufacturer, including fire-resistance rated fiberglass frames.
4. Source Limitations: Hardware and accessories for all FRP doors and frames shall be provided by door and frame manufacturer in accordance with related Section 08711 - Door Hardware.
5. Substitutions: Substitution items will be subject to compliance with the requirements of this section and must provide all the functions and features of the specified product or it will not be approved as equal.

    a. Equivalency: It shall be the responsibility of the contractor to furnish all necessary items (samples, product data, all listing reference standards, etc.) in a clear and orderly format in order to show compliance and equivalency.
    b. Equivalency Format: Should be as simple as a "side-by-side" comparison (via table, chart, etc.) between the substitution item and the basis-of-design specified item so that the substitution item is easily shown to be equivalent. If the substitution item is not easily compared to be equivalent it will not be approved as equal.

C. Referenced Standards

1. ANSI A250.4 1,000,000 cycle test.
2. ANSI A117.1 specifications for handicap accessibility, ADA requirements.
3. NFPA 80 for fire-rated class.
4. NFPA 252 fire-rated door, panel, and frame construction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Each door and frame shall be delivered to jobsite in an adequate crate and/or carton as required for protection from damage. Each crate / carton shall be clearly marked with project information, door location, specific reference number as shown on drawings, and shipping information.

B. Doors and frames shall be stored in the original container in a vertical position, clear of the floor, out of inclement weather and/or extreme temperatures for protection against damage. Provide blocking between doors to permit air circulation between the doors and to prevent damage to the door faces.

C. Handle doors and frames pursuant to the manufacturer's recommendations.

D. Use care in handling FRP doors and frames to prevent damage to factory finish. Wear protective gloves when handling product. Do not slide or drag doors or frames against one another.

E. All damaged or otherwise unsuitable doors and frames shall be immediately removed from the jobsite.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 WARRANTY

A. Provide that the structural integrity of the doors and frames have not been violated or compromised, provide the following:

1. ANSI A250.4 1,000,000 cycle test.Warranty all fiberglass doors and frames for a period of 10 years against failure due to corrosion.
2. Warranty all fiberglass doors and frames on materials and workmanship for a period of 10 years, including warp, separation or delamination, and expansion of the core.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements specified throughout this Section, provide heavy-duty FRP door and frame products by one of the following:

1. Chem-Pruf Door Company, Ltd., Brownsville, TX. (excluding Simon Door Co.)
2. Tiger Door Company, LLC, Greensburg, PA.
3. Corrim Company, Oshkosh, WI.
4. Or approved equal as outlined in Section 1.4.

2.2 FRP DOORS

A. Doors shall be made of fiberglass reinforced plastic (FRP) using chemically proven resins resistant to contaminants typically found in the environment for which these specifications are written. Doors shall be 1 3/4 inch thick and of flush construction, having no seams or cracks. All doors up to 4'0 x 8'0 shall have equal diagonal measurements with a maximum tolerance of +/- 1/32 inch.

B. Comply with ASTM E 84, or UL 723 for low flame spread rating of 25 or less.

C. Door Plates shall be from one of the following methods:

1. Molded in one continuous piece, starting with a 25-mil gelcoat of the color specified, integrally molded with at least two layers of 1.5 ounce per square foot fiberglass. Door plate weight shall not be less than 0.97 pounds per square foot with a 30/70 fiberglass to resin.
2. Face sheets shall be manufactured using a corrosion resistant resin system with light stabilizing additives. The resin shall be reinforced with fiberglass, 50% average by weight for enhanced strength. Face sheets shall be a minimum of 0.125 inch thick fiberglass.
3. Facing shall be 0.120” composite FRP sheet exterior grade, fiber reinforced lastic panel on interior and exterior faces. Colored pigment shall be maximum amont formulated with the resin. FRP sheets shall be USDA acceptable, non-porous, meeting the Class C requirements of ASTM E84.

D. Stiles and rails shall be constructed from one of the following methods:

1. A matrix of at least three layers of 1.5 ounce per square foot of fiberglass mat. The stile and rail shall be molded in one continuous piece to a U-shaped configuration and to the exact dimensions of the door. In this manner there will be no miter joints or disparate materials used to form the one-piece stile and rail. Stiles and Rails for rated openings: Core shall be banded with firestop per factory drawings.
2. A pultruded FRP square or rectangular tube sub-frame, minimum 1 ¼" x 1 ¼" x ¼" thick, is to be provided within the door.

E. Core material: shall have an R Factor = 11 and properties that comply with ASTM E 84 or UL 723 for low flame spread rating of 25 or less and complies with the International Building Code. Core shall be constructed from one of the following methods:

1. Polypropylene plastic honeycomb core with a non woven polyester veil for unparalleled plate bonding.
2. Phenolic impregnated resin paper honeycomb core.
3. Phenolic impregnated resin kraft paper honeycomb core.
4. Mineral core for 30 minute to 90 minute fire-rated doors.

F. Internal reinforcement: Provide internal reinforcement sufficient amount to adequately support required hardware and function of the same.

G. Finish of door and frame shall be identical. Colors, for both doors and frames, to be chosen from manufacturer's full range of colors. Finish of door and frame shall be one of the following:

1. Textured, Semi-gloss or Matte finish. Secondary painting to achieve color or finish is not acceptable.

H. Window openings shall be provided for at time of manufacture and shall be completely sealed so that the interior of the door is not exposed to the environment. Retainers shall have a profile that drains away from glazing. The retainers must match the color, texture, and finish of the door plates. Glass shall be provided by door and frame manufacturer. At time of manufacture.

I. Provisions for lights and louvers shall be performed during manufacture and shall not be attempted in the field. Cutouts are to be totally enclosed by FRP stile and rail framing incorporated into the door structure. Light and louver cutouts that expose core material are not acceptable.

2.3 FRP FRAMES

A. Non-Fire-rated Frames: Provide FRP door frames of seamless one-piece construction or mitered jamb/ header connections with hidden angle clips and associated fasteners.

1. Seamless one-piece construction shall be chemically welded with FRP material and ground smooth at frame face and throat so that no joint is visible.
2. Post and beam corners will not be acceptable.
3. Exposed fasteners for miter connections will not be acceptable except for wrap wall applications.

B. Finish of door and frame shall be identical. Colors, for both door and frame, to be chosen from manufacturer's full range of colors. Finish of door and frame shall be one of the following:

1. Textured, Semi-gloss or Matte finish. Secondary painting to achieve color or finish is not acceptable.

C. Internal Reinforcement shall be one of the following:

1. Continuous within the structure to allow for mounting of specified hardware. Reinforcing material shall have a minimum hinge screw holding value of 1,000 lbs per screw.

Documented strength of frame screw holding value after third insert must be submitted. Dissimilar materials, such as steel, wood, etc. will be deemed unacceptable as reinforcement for hardware attachment.

2. FRP reinforcement shall be chemically welded to door frame material at required locations. Minimum screw pullout strength of 1100 lbs. per #12 x 1" sheet metal screw is required. Mechanically fastened reinforcements are not permitted.

D. Doors and Frames shall be factory mortised to receive specified hardware.

E. Comply with ASTM E 84 or UL 723, and the International Building Code for low flame spread rating of 25 or less.

PART 3 - EXECUTION

3.1 VERIFICATION OF CONDITIONS

A. Examine conditions under which construction activities of this section are to be performed, with Installer present, for compliance with requirements and submit a written report to general contractor if conditions are unacceptable.

B. General Contractor shall submit two copies of the Installer’s report to the A/E Consultant within 24 hours of receipt of report.

C. Verify openings are correctly prepared to receive doors and frames.

D. Verify openings are correct size and depth in accordance with shop drawings or submittals.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fiberglass reinforced plastic work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Field alteration of doors or frames to accommodate field conditions is strictly prohibited.

C. Fire labeled doors and frames must be installed in strict accordance with manufacturer’s instructions and the current versions of the following:

1. I.B.C., Section 715, Opening Protectives.
2. UL 10C, for side-hinged or pivot swinging doors, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
3. UL 10B, for other types of doors, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
4. NFPA 80, Standard for Fire Doors and Other Opening Protectives.
5. NFPA 257, Standard on Fire Tests for Window and Glass Block Assemblies.

3.3 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including FRP work that is warped, bowed, or otherwise unacceptable.

B. Adjust doors in accordance with door manufacturer's maintenance instructions to swing open and shut without binding and to remain in place at any angle without being moved by gravitational influence.

C. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instructions.

D. Clean surfaces of door opening assemblies and exposed door hardware in accordance with respective manufacturer's maintenance instructions. Only use cleaning products that will not scratch or damage the surfaces and are recommended by the manufacturer

3.4 PROTECTION OF INSTALLED PRODUCTS

A. Protect door opening assemblies and door hardware from damage by subsequent construction activities until final inspection.

END OF SECTION 082200

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SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulated service door.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.
2. Division 26 Sections for electrical service and connections for powered operators and accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.

1. Wind Loads: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

C. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 20 lbf/sq. ft. wind load, acting inward and outward.

1.4 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:

1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.

2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
5. Show locations of controls, locking devices, and other accessories.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

D. Qualification Data: For qualified Installer.

E. Seismic Qualification Certificates (where applicable): For overhead coiling doors**,** accessories, and components, from manufacturer.

F. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operating mechanisms from overhead coiling door manufacturer.

C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

PART 2 - PRODUCTS

2.1 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Aluminum Door Curtain Slats: ASTM B 209 (ASTM B 209M) sheet or ASTM B 221 (ASTM B 221M) extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of 0.050 inch (1.27 mm) and as required to meet requirements.
2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.
3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
4. Gasket Seal: Provide insulated slats with manufacturer's standard interior-to-exterior thermal break or with continuous gaskets between slats.

B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from manufacturer's standard extrusions to match curtain slats and finish.

D. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.2 HOOD

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Aluminum: 0.040-inch- thick aluminum sheet complying with ASTM B 209 (ASTM B 209M), of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.
2. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

2.3 LOCKING DEVICES

A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock Cylinders: Provide cylinders standard with manufacturer and keyed to building keying system.
2. Keys: Provide Three for each cylinder.

B. Chain Lock Keeper: Suitable for padlock.

2.4 CURTAIN ACCESSORIES

A. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.

1. At door head, use 1/8-inch- thick, replaceable, continuous sheet secured to inside of hood.
2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.

B. Manual Door Operator: Chain-hoist operator.

C. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

1. Provide pull-down straps or pole hooks for doors more than 84 inches high.

2.5 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.6 DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ACME Rolling Doors.
b. Alpine Overhead Doors, Inc.
c. AlumaTek, Inc.
d. C.H.I. Overhead Doors.
e. City-Gates.
f. Cookson Company.
g. Cornell Iron Works, Inc.
h. Dynamic Closures Corp.
i. Lawrence Roll-Up Doors, Inc.
j. Mahon Door Corporation.
k. McKeon Rolling Steel Door Company, Inc.
l. Metro Door.
m. Overhead Door Corporation.
n. Raynor.
o. Southwestern Steel Rolling Door Co.
p. Wayne-Dalton Corp.
q. Windsor Door.

B. Operation Cycles: Not less than 20,000.

C. R-Value: R-6 minimum.

D. STC Rating: 21.

E. Door Curtain Material: Aluminum.

F. Door Curtain Slats: Flat profile.

1. Insulated-Slat Interior Facing: Metal.

G. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

H. Hood: Aluminum.

1. Shape: As shown on Drawings.
2. Mounting: As shown on Drawings.

I. Locking Devices: Equip door with locking device assembly.

1. Locking Device Assembly: locking bars, operable from inside with thumb turn - outside with cylinder.

J. Door Finish:

1. Aluminum Finish: Mill.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Mill Finish: Manufacturer's standard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide weathertight fit around entire perimeter.

END OF SECTION 083323

SECTION 087100 - DOOR HARDWARE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

1. Hinges.
2. Lock cylinders and keys.
3. Lock and latch sets.
4. Closers.
5. Exit Devices.
6. Door trim units.
7. Weatherstripping for exterior doors.
8. Thresholds.

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

1. Division 8 Section "FRP Doors and Frames" for factory pre-fitting and factory pre-machining of doors for door hardware.

C. References: Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.

1. Builders Hardware Manufacturing Association (BHMA)
2. NFPA 101 Life Safety Code
3. NFPA 80 -Fire Doors and Windows
4. ANSI-A156.xx- Various Performance Standards for Finish Hardware
5. UL10C – Positive Pressure Fire Test of Door Assemblies
6. ANSI-A117.1 – Accessible and Usable Buildings and Facilities
7. DHI /ANSI A115.IG – Installation Guide for Doors and Hardware
8. ICC – International Building Code

D. Intent of Hardware Groups:

1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
2. Where items of hardware aren’t definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other

discrepancy to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.

B. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

C. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

a. Type, style, function, size, and finish of each hardware item.
b. Name and manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.
e. Explanation of all abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for hardware.
g. Door and frame sizes and materials.
h. Keying information.

2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.
3. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

D. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.4 SUBSTITUTIONS:

A. Comply with Division 1.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.

B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.

1. Require supplier to meet with Owner to finalize keying requirements and to obtain final instructions in writing.

C. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by UL, Warnock Hersey, FM, or other testing and inspecting organization acceptable to authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire-rated door and door frame labels.

1. Comply with requirements of the current Kentucky Building Code.

1.6 PRODUCT HANDLING

A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.

C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).

E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.7 WARRANTY

A. Refer to Conditions of the Contract.

B. Manufacturer’s Warranty:

1. Closers: Ten years
2. Exit Devices: Five Years
3. Locksets & Cylinders: Three years
4. All other Hardware: Two years.

1.8 OWNER’S INSTRUCTION:

A. Instruct Owner’s personnel in operation and maintenance of hardware units.

1.9 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 – PRODUCTS

2.1 SCHEDULED HARDWARE

A. Manufacturer's Product Designations: Manufacturers whose products are specified in the Hardware Schedule at the end of this Section are designated with an asterisk in the listing below. A specific manufacturer’s product designation is listed in the Hardware Schedule for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is specified below for each hardware type, the comparable product of one of the other manufacturers that complies with requirements.

2.2 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Butts and Hinges:

a. Hager Hinge Co.*
b. Lawrence Brothers, Inc.
c. McKinney Products Co.
d. H. Soss & Company.

e. Stanley Hardware, Div. Stanley Works.

2. Locks:

a. Arrow Lock Manufacturing Co.
b. Corbin & Russwin Architectural Hardware, Div. Black & Decker Corp.
c. Falcon Lock Co.
d. Sargent Manufacturing Company.
e. Schlage Lock, Div. Ingersoll-Rand Door Hardware Group.
f. Yale Security Inc.*

3. Overhead Closers:

a. Dorma Door Controls International.
b. LCN, Div. Ingersoll-Rand Door Hardware Group.
c. Norton Door Controls, Div. Yale Security Inc.*
d. Rixson-Firemark, Div. Yale Security Inc.
e. Sargent Manufacturing Company.
f. Yale Security Inc.

4. Door Trim Units and Kick Plates:

a. Baldwin Hardware Corp.
b. Brookline Industries, Div. Yale Security Inc.
c. Builders Brass Works Corp.
d. Hager Hinge Co.
e. H. B. Ives, A Harrow Company.
f. Triangle Brass Manufacturing Company (Trimco).*

5. Door Stripping and Seals:

a. Hager Hinge Co.
b. National Guard Products, Inc.*
c. Pemko Manufacturing Co., Inc.
d. Reese Enterprises, Inc.
e. Sealeze Corp.
f. Ultra Industries.
g. Zero International, Inc.

6. Thresholds:

a. Hager Hinge Co.
b. National Guard Products, Inc.*
c. Pemko Manufacturing Co., Inc.
d. Reese Enterprises, Inc.
e. Sealeze Corp.
f. Zero International, Inc.

7. Exit Devices:

    a. Monarch
    b. Von Duprin, Inc.
    c. Yale Security Inc.*

8. Stops:

    a. Triangle Brass Manufacturing Company (Trimco).*
    b. Glynn-Johnson Corp.

9. Electric Strike:

    a. HES (ASSA ABLOY).*
    b. Trimco.

2.3 MATERIALS AND FABRICATION

A. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units for finish designations indicated.

B. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

C. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.

D. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex screw fasteners.

2.4 HINGES, BUTTS, AND PIVOTS

A. Templates: Provide template-produced units.

B. Screws: Provide Phillips flat-head screws complying with the following requirements:

1. For metal frames install machine screws into drilled and tapped holes.
2. For wood doors install wood screws.

3. For fire-rated wood doors install #12 x 1-1/4-inch, threaded-to-the-head steel wood screws.
4. Finish screw heads to match surface of hinges or pivots.

C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

1. Out-Swing Corridor Doors with Locks: Nonremovable pins.
2. Interior Doors: Nonrising pins.
3. Tips: Flat button and matching plug, finished to match leaves, except where hospital tip (HT) indicated.

D. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges per door leaf for doors 90 inches or less in height and one additional hinge for each 30 inches of additional height.

1. Fire-Rated Doors: Not less than 3 hinges per door leaf for doors 86 inches or less in height with same rule for additional hinges.

2.5 LOCK CYLINDERS AND KEYING

A. Review the keying system with the Owner and provide the type required (master, grandmaster or great-grandmaster), either new or integrated with Owner's existing system.

B. Equip locks with ‘Best’ Interchangeable core cylinders.

C. Metals: Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.

D. Comply with Owner's instructions for master keying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks.

E. Key Material: Provide keys of nickel silver only.

F. Key Quantity: Furnish 3 change keys for each lock, 5 master keys for each master system, and 5 grandmaster keys for each grandmaster system.

1. Deliver keys to Owner.

2.6 LOCKS, LATCHES, AND BOLTS

A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curvedlip extended to protect frame, finished to match hardware set, unless otherwise indicated or recommended by manufacturer.

1. Provide recess type top strikes for bolts locking into head frames, unless otherwise indicated.
2. Provide dust-proof strikes for foot bolts.

B. Lock Throw: Provide 5/8-inch minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.

1. Provide 1/2-inch minimum throw of latch for other bored and preassembled types of locks and 3/4-inch minimum throw of latch for mortise locks. Provide 1-inch minimum throw for all dead bolts.

2.7 CLOSERS

A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit depending on size of door, exposure to weather, and anticipated frequency of use.

1. Where parallel arms are indicated for closers, provide closer unit one size larger than recommended for use with standard arms.
2. Provide all door closers with thru-bolts and grommets.
3. Provide parallel arms for all overhead closers, except as otherwise required or recommended.
4. Provide adjustable units complying with ANSI A117.1 and ADA provisions for door opening force and delayed action closing.

2.8 DOOR TRIM UNITS

A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.

B. Fabricate protection plates not more than 1-1/2 inches less than door width on hinge side and not more than 1/2 inch less than door width on pull side by height indicated.

1. Metal Plates: Stainless steel, 0.050 inch (U.S. 18 gage).

2.9 WEATHERSTRIPPING AND SEALS

A. General: Provide continuous weatherstripping on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

B. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.

C. Weatherstripping at Jambs and Heads: Provide bumper-type resilient insert and metal retainer strips, surface applied unless shown as mortised or semimortised.

2.10 THRESHOLDS

A. General: Except as otherwise indicated, provide standard metal threshold unit of type, size, and profile as shown or scheduled.

2.11 HARDWARE FINISHES

A. Match items to the manufacturer's standard color and texture finish for the latch and lock sets (or push-pull units if no latch or lock sets).

B. Provide finishes that match those established by BHMA or, if none established, match the Architect's sample.

C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

D. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze, and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer."

E. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.

1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
2. NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors."
3. Requirements of Americans with Disabilities Act (ADA).

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealers."

F. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.2 ADJUSTING, CLEANING, AND DEMONSTRATING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

B. Clean adjacent surfaces soiled by hardware installation.

C. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.

3.3 HARDWARE SCHEDULE

A. General: Provide hardware for each door to comply with requirements of Section "Door Hardware," hardware set numbers indicated in door schedule, and in the following schedule of hardware sets.

1. Hardware sets indicate quantity, item, manufacturer and product designation, size, and finish or color, as applicable.

B. HARDWARE SCHEDULE:

Hardware Set No. 1: (Door 101)

(3) ea	Hinge	BB1199 4.5 x 4.5 x SS
(1) ea	Lever Trim	PB541F x US26D
(1) ea	Exit Device	7100(F) x Alum
(1) ea	Electric Strike	9400 x 630
(1) ea	Closer	4400 Series x (CUSH) x Alum
(1) ea	Kickplate	K0050 x 12”(H) x SS
(1) ea	Weatherstripping	2525 x Color as selected by Architect
(1) ea	Threshold	950V x Alum
(1) ea	Bumper Seal	Manf. Std. Neoprene x Color as selected by Architect

NOTE: Refer to Electrical drawings and specifications for HID proximity reader information.

END OF SECTION 087100

DIVISION 09

FINISHES

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SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.

B. Related Sections include the following:

1. Division 09 “High Performance Paints and Coatings” Sections for primers and paints applied to gypsum board surfaces.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

1.5 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Gypsum Co.
b. BPB America Inc.
c. G-P Gypsum.
d. Lafarge North America Inc.
e. National Gypsum Company.
f. PABCO Gypsum.
g. Temple.
h. USG Corporation.

B. Type X:

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

2.2 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized steel sheet..
2. Shapes: Provide cornerbead and edge trim shapes as required for a complete and proper installation.

2.3 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered

edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

H. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: Where required for fire-resistance-rated assembly.
2. Moisture- and Mold-Resistant Type: As indicated on Drawings.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

C. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim:

1. Cornerbead: Use at outside corners.
2. U-Bead: Use at exposed panel edges.

3. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 5: At panel surfaces that will be exposed to view, unless otherwise indicated.

    a. Primer and its application to surfaces are specified in other Division 09 Sections.

3. Partial Finishing: Omit fourth coat and sanding on concealed drywall work which is indicated for drywall finishing or which requires finishing to achieve fire-resistance rating or to act as air or smoke barrier.

3.6 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

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SECTION 099600 - HIGH PERFORMANCE PAINTS AND COATINGS – WATER PLANT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment and services for furnishing and installing the finishes as indicated on drawings and schedules, and as herein specified.

B. Work includes painting and finishing of interior and exterior exposed items and surfaces throughout project, except as otherwise indicated. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.

C. Work includes field painting of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated. In addition, the Contractor shall provide for the use of deep tone colors to be applied in selected areas as wall graphics, stripes and visual accents. The areas and colors shall be selected by the Architect-Engineer and shall not exceed 15% of the total wall surface area to be painted.

D. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

E. Surfaces to be Painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect-Engineer will select these from standard colors or finishes available.

F. Following categories of work are not included as part of field- applied finish work.

1. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified for such items as (but not limited to) toilet enclosures, prefinished partition systems, acoustic materials, architectural woodwork and casework, and finish mechanical and electrical equipment, including light fixtures, switchgear, and distribution cabinets.
2. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, furred areas, pipe spaces, and duct shafts.
3. Finished Metal Surfaces: Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.
4. Operating Parts: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting.

G. Following categories of work are included under other sections of these specifications.

1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, metal fabrications, hollow metal work and similar items.
2. Unless otherwise specified, shop priming of fabricated components such as architectural woodwork, wood casework and shop-fabricated or factory-built mechanical and electrical equipment or accessories is included under other sections of these Specifications.

H. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

I. PVC plastic process piping shall not be painted, but shall be stenciled and labeled or tagged for identification surfaces. Each type of process piping using PVC pipe shall be installed using the same color pipe.

J. Repainting of existing structures, tanks, piping, and all other existing items shall not be part of this Contract unless otherwise noted. Areas that have been directly altered or damaged by construction shall be repainted to match existing conditions using the appropriate painting system.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to Work of this Section.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use.

B. Samples: Prior to beginning work, submit color chips for surfaces to be painted. Use representative colors when preparing samples for review. Submit samples for Architect-Engineer's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.

C. Submit manufacturer’s data and shop drawings for the materials specified herein. Comply with all requirements of Section 013323.

D. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering.

E. At the time of submission, the Contractor shall, in writing, call the Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

F. In accordance with the requirements of the General and Special Conditions and this Section, the following table includes, but is not limited to, the items required to be submitted:

Item Description	Shop Drawings	Product Data	Schedules	Installation Data	Parts Lists	Wiring Diagram	Samples	O & M Manual	Certificates	Warranty	Report	Other
Coatings		X		X			X		X	X		

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

B. Coordination of Work: Review other sections of these Specifications in which prime paints are to be provided to ensure compatibility of total coatings systems for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

1.5 DELIVERY AND STORAGE

A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:

1. Name or title of material.
2. Fed. Spec. number, if applicable.
3. Manufacturer's stock number, batch number, and date of manufacturer.
4. Manufacturer's name.
5. Contents by volume, for major pigment and vehicle constituents.
6. Thinning instructions.
7. Application instructions.
8. Color name and number.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.6 JOB CONDITIONS

A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C), unless

otherwise permitted or restricted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F (7 degrees C) and 95 degrees F (35 degrees C), unless otherwise permitted or restricted by paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted or restricted by paint manufacturer's printed instructions. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

D. Paint only when the surface temperature is at least 5 degrees F above the dew point, unless otherwise permitted by paint manufacturer’s printed instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Tnemec Company, Inc. (Tnemec)
2. The Sherwin-Williams Company
3. Carboline

2.2 MATERIALS

A. Material Quality: Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.

B. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.

C. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

1. Lead content in pigment, if any, is limited to contain not more than 0.06% lead, as lead metal based on the total non-volatile (dry-film) of paint by weight.

PART 3 - EXECUTION

3.1 INSPECTION

A. Applicator must examine areas and conditions under which painting work is to be applied and

notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.

B. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.

C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.2 SURFACE PREPARATION

A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.

1. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Architect-Architect-Engineer in writing of any anticipated problems in using the specified coating systems with substrates primed by others.
2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.
3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning per SSPC SP-1. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.
4. Abrasives for blasting shall be sharp, washed, salt free, angular, and free from feldspar or other constituents that tend to breakdown and remain on the surface.
5. Concrete floors shall be dry as indicated by testing in accordance with ASTM D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

B. Cementitious Materials: Per ASTM D4261, Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating, prepare cementitious surfaces of concrete block to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze. Per ASTM D4262, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces, determine alkalinity of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Test the surface for moisture and do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

C. Wood: Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.

1. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets,

counters, cases, paneling.
2. When transparent finish is required, use spar varnish for backpriming.

D. Ferrous Metals: Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, and other foreign substances by solvent cleaning per SSPC SP-1. Mechanical cleaning shall be in accordance with SSPC-SP6 Commercial Blast Cleaning specifications for non-immersion surfaces and SSPC-SP10 Near White Metal Blast Cleaning for immersion in potable or non-potable water.

E. Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum based solvent. For immersion service, clean in accordance with SSPC-SP16 Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.

F. Shop Primed Surfaces: Prepare shop-applied prime coats wherever damaged or bare as required by other sections of these Specifications. Clean and touch-up with same type shop primer.

3.3 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.4 APPLICATION

A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Painting requirements, surface treatments, and finishes, are indicated in "schedules" of the contract documents and as noted in Paragraph 3.11 hereinafter.
2. Provide finish coats which are compatible with prime paints used.
3. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently- fixed equipment or furniture with prime coat only before final installation of equipment.
5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
6. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.
7. Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless otherwise indicated.
8. Sand lightly between each succeeding enamel or varnish coat.

9. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

B. Scheduling Painting: Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

D. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed in mechanical equipment rooms and in occupied spaces.

1. Mechanical items to be painted include, but are not limited to, the following:

a. Piping, pipe hangers, supplementary steel and supports except galvanized surfaces.
b. Heat exchangers.
c. Tanks.
d. Ductwork, insulation.
e. Motor, mechanical equipment, and supports.
f. Accessory items.

2. Electrical items to be painted include, but are not limited to, the following:

a. Conduits and fittings except galvanized surfaces.
b. Switchgear (touch up only).
c. Hanger and support except galvanized surfaces.

E. Prime Coats: Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by others. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

F. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable. Holiday test coated steel in immersion areas in accordance with NACE International SP0188-2007 Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

G. Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats, unless otherwise indicated.

H. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.5 FIELD QUALITY CONTROL

A. The right is reserved by Owner to invoke the following material testing procedure at any time, and any number of times during period of field painting:

1. Engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.
2. Testing laboratory will perform appropriate tests for any or all of following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.

B. If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove non-complying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

3.6 CLEAN-UP AND PROTECTION

A. Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.

B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

C. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect-Architect-Engineer. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations. At completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.7 PAINTING SYSTEMS

A. Ferrous Metals, Structural, Tanks, Pipe and Equipment

1. Exterior, Non-Immersion

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	SSPC-SP6 Commercial Blast Cleaning		SSPC-SP6 Commercial Blast Cleaning		SSPC-SP6 Commercial Blast Cleaning	
1st Coat	91H20	2.5 – 3.5	Corothane I Galvapac NSF	2.5 – 3.5	Carbozinc 859	2.5 – 3.5
2nd Coat	N69 High-Build Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0	Carboguard 60	4.0 – 6.0
3rd Coat	1074 Endura -Shield	2.0 – 3.0	Acrolon 218 HS	2.0 – 3.0	Carbothane 134 HG	2.0 – 3.0

2. Interior, Non-Immersion

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	SSPC-SP6 Commercial Blast Cleaning		SSPC-SP6 Commercial Blast Cleaning		SSPC-SP6 Commercial Blast Cleaning	
1st Coat	91H20	2.5 – 3.5	Corothane I Galvapac NSF	2.5 – 3.5	Carbozinc 859	2.0 – 3.0
2nd Coat	N69 High-Build Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0	Carboguard 60	4.0 – 6.0
3rd Coat	N69 High-Build Epoxoline	2.0 – 3.0	Macropoxy 646	2.0 – 3.0	Carboguard 60	2.0 – 3.0

3. Immersion, Potable or Non-Potable Water

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	SSPC-SP10 Near-White Blast Cleaning		SSPC-SP10 Near-White Blast Cleaning		SSPC-SP10 Near-White Blast Cleaning	
1st Coat	N140	4.0 –6.0	Macropoxy 646 PW	4.0 – 6.0	Carboguard 61	4.0 – 6.0
2nd Coat	N140	4.0 – 6.0	Macropoxy 646 PW	4.0 – 6.0	Carboguard 61	4.0 – 6.0
3rd Coat	N140	4.0 – 6.0	Macropoxy 646 PW	4.0 – 6.0	Carboguard 61	4.0 – 6.0

4. Factory Primed Interior (Refer to Piping Specifications)

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
Touch up	N69 High-Build Epoxoline		Macropoxy 646		Carboguard 60	
1st Coat	N69 High-Build Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0	Carboguard 60	4.0 – 6.0
2nd Coat	N69 High-Build Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0	Carboguard 60	4.0 – 6.0

5. Factory Primed, Exterior (Refer to Piping Specifications)

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
Touch up	N69 Hi-Build Epoxoline		Macropoxy 646		Carboguard 60	
1st Coat	N69 Hi-Build Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0	Carboguard 60	4.0 – 6.0
2nd Coat	1074 Endura -Shield	2.0 – 3.0	Acrolon 218 HS, B65 Series	2.0 – 3.0	Carbothane 134 HG	2.0 – 3.0

6. Primed Steel (Doors, Frames, etc.) – Exterior

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
Touch-up	N69 High-Build Epoxoline		Macropoxy 646		Carboguard 60	
1st Coat	N 69 High-Build Epoxoline	4.0 – 6.0	Macropoxy 646	2.0 – 3.0	Carboguard 60	4.0 – 6.0
2nd Coat	1074 Endura -Shield	2.0 – 3.0	Acrolon 218 HS	2.0 – 3.0	Carbothane 134 HG	2.0 – 3.0

7. Buried

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	SSPC-SP6 Commercial Blast Cleaning		SSPC-SP6 Commercial Blast Cleaning		SSPC-SP6 Commercial Blast Cleaning	
1st Coat	Hi-Build Tneme-Tar	16.0 – 20.0	Hi-Mil Sher-Tar Epoxy	16.0 – 24.0	Bitumastic 300M	16.0 – 24.0

B. Galvanized Steel - Pipe and Miscellaneous Fabrications

1. Exterior, Non-Immersion

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	SSPC-SP1 Solvent Cleaning		SSPC-SP1 Solvent Cleaning		SSPC-SP1 Solvent Cleaning	
1st Coat	N69 Hi-Build Epoxoline	4.0 – 6.0	Macropoxy 646	2.0 – 3.0	Carboguard 60	4.0 – 6.0
2nd Coat	1074 Endura -Shield	2.0 – 3.0	Acrolon 218 HS	2.0 – 3.0	Carbothane 134 HG	2.0 – 3.0

2. Interior, Non-Immersion (Doors, Frames, etc.)

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	SSPC-SP1 Solvent Cleaning		SSPC-SP1 Solvent Cleaning		SSPC-SP1 Solvent Cleaning	
1st Coat	N69 Hi-Build Epoxoline	4.0 – 6.0	Macropoxy 646	2.0 – 3.0	Carboguard 60	4.0 – 6.0
2nd Coat	N69 Hi-Build Epoxoline	4.0 – 6.0	Macropoxy 646	2.0 – 3.0	Carboguard 60	2.0 – 3.0

3. Immersion, Potable or Non-Potable Water

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	SSPC-SP16 Brush-Off Blast Cleaning		SSPC-SP16 Brush-Off Blast Cleaning		SSPC-SP16 Brush-Off Blast Cleaning	
1st Coat	20-1255 Potapox	4.0 – 6.0	Macropoxy 646 NSF	4.0 – 6.0	Carboguard 61	4.0 – 6.0
2nd Coat	20-11 WH Potapox	4.0 – 6.0	Macropoxy 646 NSF	4.0 – 6.0	Carboguard 61	4.0 – 6.0

C. Porous Masonry - Concrete Masonry Units

1. Interior

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
1st Coat	130 Envirofill (Spray and Back Roll to Fill Porosity)	80 - 100 sf/gal.	Pro-Industrial Hi-Bild Waterbased Catalyzed Epoxy	80-100 sf/gal	Carboline Sanitile 100	80 - 100 sf/gal
2nd Coat	113 H.B. Tneme-Tufcoat	2.0 – 3.0	Pro-Industrial Hi-Bild Waterbased Catalyzed Epoxy	2.0–3.0	Sanitile 255	2.0 – 3.0
3rd Coat	113 H.B. Tneme-Tufcoat	2.0 – 3.0	Pro-Industrial Hi-Bild Waterbased Catalyzed Epoxy	2.0–3.0	Sanitile 255	2.0 – 3.0

2. Exterior

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
1st Coat	Series 156 Enviro-Crete	6.0 – 8.0*	Loxon XP	6.0-8.0*	Flexxide Elastomer	6.0 - 8.0*
2nd Coat	Series 156 Enviro-Crete	6.0 – 8.0*	Loxon XP	6.0-8.0*	Flexxide Elastomer	6.0 – 8.0*

*Coats must be sufficient to fill the porosity of the block face and create a pinhole-free surface.

D. Cast-In-Place Concrete

1. Concrete Walls & Precast Concrete Ceilings (Interior)

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	SSPC-SP13 Abrasive Blast		SSPC-SP13 Abrasive Blast		SSPC-SP13 Abrasive Blast	
1st Coat	113 H.B. Tneme Tuf-coat	4.0–6.0	Pro-Industrial Hi-Bild Waterbased Catalyzed Epoxy	4.0 – 6.0	Sanitile 255	2.0 – 3.0
2nd Coat	113 H.B. Tneme Tuf-coat	4.0–6.0	Pro-Industrial Hi-Bild Waterbased Catalyzed Epoxy	4.0 – 6.0	Sanitile 255	2.0 – 3.0

2. Concrete Walls, Exterior & Non-Potable

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
1st Coat	Series 156 Enviro-Crete	125 sf/gal	Loxon Masonry Primer	125 sf/gal	Flexxide Elastomere	125 sf/gal
2nd Coat	Series 156 Enviro-Crete	200 sf/gal	Loxon Masonry Coating	200 sf/gal	Flexxide Elastomere	200 sf/gal

3. Concrete Floors

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	Pressure Wash					
1st Coat	ChemProbe CT Densifyer Series 629 or 617					
2nd Coat	ChemProbe CT Densifyer Series 629 or 617					

4. Concrete Tanks & Basins

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	SSPC-SP13, Severe Service Abrasive Blast		SSPC-SP13, Severe Service Abrasive Blast		SSPC-SP13, Severe Service Abrasive Blast	
1st Coat	N140	4.0 – 6.0	Macropoxy 646 PW	4.0 – 6.0	Carboguard 61	4.0 – 6.0
2nd Coat	N140	4.0 – 6.0	Macropoxy 646PW	4.0 – 6.0	Carboguard 61	4.0 – 6.0
3rd Coat	N140	4.0 – 6.0	Macropoxy 646PW	4.0 – 6.0	Carboguard 61	4.0 – 6.0

5. Chemical Containment Areas - Acid Exposure

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	SSPC-SP13, Severe Service Abrasive Blast		SSPC-SP13, Severe Service Abrasive Blast		SSPC-SP13, Severe Service Abrasive Blast	
1st Coat	Series 120-5002 Vinyl Ester	12 – 18	CoroBond Vinyl Ester Primer	3.5 – 4.0	Semstone 800	8.0 – 10.0
2nd Coat	Series 120-5002 Vinyl Ester	12 - 18	CorCote VEN FF	15.0 – 20.0	Semstone 870 (aggregate-filled)	25.0 – 30.0
3rd Coat			CorCote VEN FF with Wax Solution	15.0 – 20.0	Semstone 870	15.0 – 20.0

6. Chemical Containment Areas - Other

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	SSPC-SP13, Severe Service Abrasive Blast		SSPC-SP13, Severe Service Abrasive Blast		SSPC-SP13, Severe Service Abrasive Blast	
1st Coat	201 Epoxoprime	6.0 – 8.0	CoroBond 100	6.0 – 8.0	Semstone 110	8.0 – 10.0
2nd Coat	275 Stranlock	25.0 – 40.0	CorCote HCR Flake-Filled	15.0 – 20.0	Semstone 140	25 mils (Broadcast Silica)
3rd Coat	282 Tneme-Glaze	8.0 – 12.0	CorCote HCR	15.0 – 20.0	Semstone 140	15.0 – 25.0

E. Wood

1. Interior or Exterior

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
1st Coat	151-1051 Elasto-Grip FC	1.0 – 1.5	Multi-Purpose Latex Primer	1.0 – 1.5	Carbocrylic 120	1.0 – 2.0
2nd Coat	1029 Tufcryl	2.0–3.0 - 3.5	DTM Acrylic Coating	2.0 – 3.0	Carbocrylic 3359 DTM	2.0 – 3.0
3rd Coat	1029 Tufcryl	2.0 – 3.0	DTM Acrylic Coating	2.0 – 3.0	Carbocrylic 3359 DTM	2.0 – 3.0

F. Insulated Pipe

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
1st Coat	1029Tneme-Cryl	2.0 – 3.0	DTM Primer/Finish, B66W1	2.0 – 3.0	Carbocrylic 120	1.0 – 2.0
2nd Coat	1029 Tneme-Cryl	2.0 – 3.0	DTM Primer/Finish, B66W1	2.0 – 3.0	Carbocrylic 3359 DTM	2.0 – 3.0

G. Gypsum Board

1. Interior Drywall – Architectural

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
1st Coat	151-1051 Elasto-Grip FC	1.0 – 1.5	PrepRite 200 Printer	1.0 – 1.5	Carbocrylic 120	1.0 – 2.0
2nd Coat	6-Color Tneme-Cryl	2.0 – 3.0	ProMar 200 F, SF, EgShel	1.0 – 1.5	Carbocrylic 3359 DTM	2.0 – 3.0

2. Interior Drywall - Severe Exposure

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
Prime Coat	151-1051 Elasto-Grip FC	1.0 – 1.5	PrepRite 200 Primer	1.0 – 1.5	Sanitile 120	1.0 – 2.0
1st Coat	113 H.B. Tneme-Tufcoat	2.0 – 3.0	Pro-Industrial Hi-Bild Waterbased Catalyzed Epoxy	2.0 – 3.0	Carboline Sanitile 255	2.0 – 3.0
2nd Coat	113 H.B. Tneme-Tufcoat	2.0 – 3.0	Pro-Industrial Hi-Bild Waterbased Catalyzed Epoxy	2.0 – 3.0	Carboline Sanitile 255	2.0 – 3.0

H. PVC Piping – Do Not Paint

I. Aluminum Windows, Doors, Handrails & Grating – Do Not Paint

J. Fiberglass Reinforced Plastic Doors & Windows – Do Not Paint

3.8 PIPING COLOR CODE

A. To facilitate identification of piping in plants and pumping stations it is recommended that the following color scheme be utilized:

WATER LINES	
Raw Water	Olive Green
Settled Water	Light Blue
Filtered, Finished or Potable Water	Dark Blue

CHEMICAL LINES	
Alum or Primary Coagulant	Orange
Ammonia	White
Carbon Slurry	Black
Caustic	Yellow w/ green band
Chlorine	Yellow
Lime Slurry	Light Green
Fluoride	Light Blue w/ red band
Polymers or Coagulant Aid	Orange w/ green band
Potassium Permanganate	Violet
Soda Ash	Light Green w/ orange band
Sulfur Dioxide	Light Green w/yellow band

WASTE LINES	
Backwash Waste	Light Brown
Sewer (Sanitary or Other)	Dark Gray
Sludge	Dark Brown

OTHER	
Compressed Air	Dark Green
Gas	Red
Other Lines	Light Gray

3.9 STENCILING

A. The Contractor shall supply all materials and labor necessary for stenciling of legends on pipes. The legend shall show the name of the contents. Review by the Architect-Engineer of legends will be required. Names shall be "plainly visible". Arrows showing direction of flow shall also be stenciled on pipes. The legends shall be located not more than 10 feet apart and, in general, at each valve and piece of equipment. The size and location of the legend shall be in general accordance with ANSI A13.1-1981 “Scheme for the Identification of Piping Systems". All visible piping 6" in diameter and larger shall be color-coded and stenciled. "Stick-on" labels are not acceptable.

3.10 PLASTIC IDENTIFICATION MARKERS

A. All visible piping 3/4" and greater and less than 6" which is accessible for maintenance operations shall be color-coded and identified with semi-rigid plastic identification markers equal to SETMARK Pipe Markers as manufactured by Seton Name Plate Corporation, New Haven, Conn.; T & B/Westline, Los Angeles, California; or equal. Direction of flow arrows are to be included on each marker, unless otherwise specified.

B. Each marker background is to be appropriately color coded with a clearly printed legend to identify the contents of the pipe in conformance with the "Scheme for the Identification of Piping Systems” (ANSI A 13.1 - 1981).

C. For pipes under 3/4" O.D. (too small for color bands and legends), brass identification tags 1-1/2" in diameter with depressed 1/4" high black-filled letters above 1/3" blackfilled numbers shall be fastened securely at specified locations.

D. All electrical conduits, which are accessible for maintenance operations, shall be identified with semi-rigid identification markers similar to those specified above.

E. Each marker background is to be color-coded with a clearly printed legend to identify the conductor. Size of markers and sizes of lettering to generally conform with the "Scheme for Identification of Piping Systems" (ANSI A 13.1 - 1981)

F. Locations for pipe and electrical markers to be as follows:

1. Adjacent to each valve and fitting (except on plumbing fixtures and equipment).
2. At each branch and riser take-off.
3. At each pipe passage through wall, floor and ceiling construction.
4. At each pipe passage to underground.
5. On all horizontal pipe runs-marked every 25 feet.

3.11 PAINT SCHEDULE

All items at the Project site shall be painted in accordance with these Specifications and Drawings. The following paint schedule is provided only to assist the Owner and Contractor in selection of the appropriate paint system and is not intended to be a complete list of items to be painted.

A. Paint Application Schedule

Location and/or Description		System
1.	Sodium Hypochlorite Building	
a.	Block Walls	C.1
b.	Drywall Ceiling	G.1
c.	Concrete Floors	D.3
d.	Ferrous Metal Piping & Equipment	A
e.	Chemical Containment Areas	D.6
f.	PVC Piping, Valve & Accessories	Do Not Paint

END OF SECTION 099600

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DIVISION 10

SPECIALTIES

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SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Portable, hand-carried fire extinguishers
2. Mounting brackets for fire extinguishers.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

C. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain fire extinguishers, cabinets, and brackets from one source from a single manufacturer.

B. UL-Listed Products: Fire extinguishers UL-listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Fire-End & Croker Corporation.
2. Guardian Fire Equipment, Inc.

3. J.L. Industries, Inc.: a division of the Activar Construction Products Group.
4. Larsen's Manufacturing Company.
5. Nystrom, Inc.
6. Potter-Roemer, Inc.
7. Strike First Corporation of America.

2.2 FIRE EXTINGUISHERS

A. General: Provide fire extinguishers for each location indicated, in colors and finishes selected by Architect from manufacturer's standard, which comply with requirements of governing authorities.

1. Fill and service extinguishers to comply with requirements of governing authorities and manufacturer.
2. Abbreviations indicated below identify extinguisher types related to UL classification and rating system and not necessarily to type and amount of extinguishing material contained in extinguisher.

B. Multipurpose Dry Chemical Type:

1. Office Area: UL-rated 4A-800 B:C, 10-lb. nominal capacity, in enameled steel container.
2. Maintenance Area: UL-rated 20A-120 B:C, 20-lb. nominal capacity, in enameled steel container.

2.3 MOUNTING BRACKETS

A. Provide brackets designed to prevent accidental dislodgement of extinguisher, of sizes required for type and capacity of extinguisher indicated in plated finish.

1. Provide brackets for extinguishers not located in cabinets.
2. Provide manufacturers option brackets with dual latching straps, unless otherwise directed by the Architect.

B. Identification: Identify bracket-mounted extinguishers with red letter decals spelling "FIRE EXTINGUISHER" applied to wall surface.

1. Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
2. Letter size, style, and location as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities, including ADA requirements.

1. Securely fasten mounting brackets to structure, square and plumb, at locations noted, to comply with manufacturer's instructions.

END OF SECTION 104416

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SECTION 107445 – ACCESS HATCHES

PART 1 – GENERAL

Per Addendum No. 1 *(4/27/15)* *Chemical Feed Vault Access Hatch - Access hatch for the chemical feed vaults shall be of the angle frame type and reference to the odor resistant gasket is not required.*

1.1 SCOPE OF WORK

A. Provide all labor, materials, equipment, and service required for the complete installation of the access hatches as specified herein and shown on the Drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Cast-in-Place Concrete: Section 033100

B. Precast Concrete Structures: Section 034000

1.3 SUBMITTALS

A. Submit manufacturer's data and shop drawings for the materials specified herein. Comply with all requirements of Section 013323.

B. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering.

C. At the time of submission, the Contractor shall, in writing, call the Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

D. In accordance with the requirements of the General and Special Conditions and this Section, the following table includes, but is not limited to, the items required to be submitted:

Item Description	Shop Drawings	Product Data	Schedules	Installation Data	Parts Lists	Wiring Diagram	Samples	O & M Manual	Certificates	Warranty	Report	Other
Access Hatches	X	X		X						X		

1.4 ACCEPTABLE MANUFACTURERS

A. Access hatches shall be as manufactured by the Bilco Company, New Haven, Connecticut; Babcock-Davis Associates, Inc., Arlington, Massachusetts; Milcor Division Inryco, Inc., Milwaukee, Wisconsin; or equal.

PART 2 – PRODUCTS

2.1 ACCESS HATCH FOR CHEMICAL FEED VAULT

A. Access hatch shall be single leaf, aluminum, angle frame, exterior, flush floor hatch design. Hatch shall be constructed of ¼ inch aluminum cover and extruded aluminum frame. Hatch cover shall be a diamond-pattern tread plate reinforced for 150 pounds per square foot (psf) live load. Hatch frame shall be extruded aluminum angle frame with steel strap anchors bolted around the perimeter.

B. Hatch door shall be equipped with cast steel cam-action hinges that are concealed from the exterior of the door and a 316 stainless steel slam lock latch with fixed interior handle and removable exterior turn/lift handle. The access hatch shall have torsion bars that pivot on cam-action hinges and automatic hold-open arm with grip handle release for lift assistance.

C. Doors and frames shall be mill finish with bituminous coating applied to the exterior of the frame. Hatches shall have an odor resistant gasket. Hardware shall be zinc plated and chromate sealed.

D. Size of hatch shall be 3’-0” by 3’-0”.

PART 3 – EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with manufacturer’s instructions.

B. Manufacturer shall guarantee against defects in material of workmanship for a period of five years.

END OF SECTION 107445

SECTION 107455 - FIBERGLASS REINFORCED PLASTIC PRODUCTS AND FABRICATIONS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary to install the fiberglass reinforced plastic (FRP) grating, stair treads, handrail, ladders and structurals as shown on the drawings and as specified herein.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

1.3 QUALITY ASSURANCE

A. The material covered by these specifications shall be furnished by a reputable and qualified manufacturer of proven ability who has regularly engaged in the manufacture and installation of FRP systems.

B. Substitution of any component or modification of system shall be made only when approved by the Engineer.

C. Fabricator Qualifications: Firm experienced in successfully producing FRP fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

D. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 DESIGN CRITERIA

A. The design of FRP products including connections shall be in accordance with governing building codes and standards as applicable.

B. Design of FRP live loads on grating shall not be less than 100 pounds per sq. ft. Grating deflection at the center of a simple span not to exceed 0.25 inch. Deflection in any direction shall not be more than L/180 of span for structural members. Connections shall be designed to transfer the above loads.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural Performance

1. Design, engineer, fabricate, and install the following FRP fabrications to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each respective component of each FRP fabrication.

B. Stair Tread Performance

1. Capable of withstanding a uniform load of 100 lbs per sq. ft. or a concentrated load of 300 lbs on an area of 4 sq. inches located in the center of the tread, whichever produces the greater stress.

C. Platforming And Stair Platform Performance

1. Capable of withstanding a uniform load of 100 lbs per sq. ft.

D. Handrails Systems Performance

1. Capable of withstanding a concentrated load of 200 lbs applied at any point noncurrently, vertically downward, or horizontally.

1.6 SUBMITTALS

A. Shop drawings of all FRP structural members, handrails, gratings, plate, ladders and appurtenances shall be submitted to the Engineer for approval in accordance with the requirements of Section 013323.

B. Manufacturer's catalog data showing:

1. Dimensions, spacings, and construction of grating
2. Design tables showing limits for span length and deflection under various uniform and concentrated toads
3. Materials of construction

C. Detail shop drawings showing:

1. Dimensions of grating, ladders, handrail, and structural members
2. Sectional assembly
3. Location and identification mark
4. Size and type of supporting frames required
5. Anchorage and accessory items.

D. Samples of each type of grating proposed shall be submitted for approval prior to placement of purchase orders.

1.7 SHIPPING AND STORAGE INSTRUCTIONS

A. All systems, sub-systems and structures shall be shop fabricated and assembled into the largest practical size suitable for transporting.

B. All materials and equipment necessary for the fabrication and installation of the grating, plate, handrails, stair treads, and structural shapes shall be stored before, during, and after shipment in a manner to prevent cracking, twisting, bending, breaking, chipping or damage of any kind to the materials or equipment, including damage due to over exposure to the sun. Any material which, in the opinion of the Engineer, has become damaged as to be unfit for use, shall be promptly removed from the site of work, and the Contractor shall receive no compensation for the damaged material or its removal.

C. Identify and match-mark all materials, items, and fabrications for installation and field assembly.

PART 2- PRODUCTS

2.1 GENERAL

A. Materials used in the manufacture of the FRP products shall be new stock of the best quality and shall be free from all defects and imperfections that might affect the performance of the finished product.

B. All materials shall be of the kind and quality specified, and where the quality is not specified, it shall be the best of the respective kinds and suitable for the purpose intended.

C. All FRP products noted in 1.02 shall be manufactured using a pultruded process utilizing either an isophthalic polyester or a vinyl ester resin with flame retardant and ultra-violet (UV) inhibitor additives. A synthetic surface veil shall be the outermost layer covering the exterior surface. The FRP shapes shall achieve a flame spread of 25 or less in accordance with ASTM test method E84. (lsophthalic polyester resin is available without flame retardant and UV inhibitor additives.)

D. After fabrication, all cut ends, holes and abrasions of FRP shapes shall be sealed with a compatible resin coating to prevent intrusion of moisture.

E. FRP products exposed to weather shall contain an ultraviolet inhibitor and shall additionally receive one mil thick 1J.V. coating to shield from ultra-violet light if specified or requested.

F. All exposed surfaces shall be smooth and true to form.

G. Manufacturers:

1. Morrision Molded Fiber Glass Company (MMFG)
2. Fibergrate
3. Approved equal

2.2 GRATINGS AND TREADS

A. General

1. Grating shall be shipped from the manufacturer, palletized and banded with exposed

edges protected by cardboard to prevent damage in shipment.

2. Each piece shall be clearly marked showing manufacturer's applicable drawing number.

B. Design

1. The panels shall be 1-1/2" deep and sustain a deflection of no more than 0.25 inches under a uniform distributed load of 100 psf for the span lengths shown on the plans.
2. The bearing bars shall be joined into panels by passing continuous length fiberglass pultruded cross rods through the web of each bearing bars. The pultruded cross rod assembly shall consist of two cross rod spacers that have notches cut into them at 1-1/2" inches on center to fit the distance between the web of each bearing bar. A continuous fiberglass pultruded bar shaped section shall be wedged between the two cross rod spacers mechanically locking the notches in the cross rod spacers to the web of the bearing bars. Chemical bonding shall be achieved between the cross rod spacers and the bearing web and between the bar shaped wedge and the two cross rod spacers locking the entire panel together to give a panel that resists twist and prevents internal movement of the bearing bars.
3. The top surface of all panels shall have a nonskid grit affixed to the surface by a baked epoxy resin followed by a top coat of baked epoxy resin.
4. Panels shall be fabricated to the sizes shown on the drawings.
5. Hold down clamps shall be type 316L stainless steel. A minimum of 4 each per panel.
6. Color shall be gray (OSHA safety gray)
7. All bearing bars that are to be exposed to UV shall be coated (optional) with polyurethane coating of a minimum thickness of I mil if desired.

C. Fabrication

1. The FRP grating and stair treads shall be fabricated from bearing bars and cross rod manufactured by the pultrusion process. The glass fiber reinforcement for the bearing bars shall be a core of continuous glass strand rovings wrapped with continuous strand glass mat. A synthetic surface veil shall be the outermost layer covering the exterior surfaces.
2. Fiberglass Grating and Stair Treads

    a. Fiberglass grating and stair treads shall be made from a premium grade chemical resistant, fire retardant isophthalic polyester or fire retardant vinyl ester resin system with antimony trioxide added to meet the flame rating of 25 or less in accordance with ASTM E-84 testing and meet the self-extinguishing requirements of ASTM D-635. U. V. inhibitors are added to the resin.

3. Grating with Plate

    a. Grating shall be the same as described above in this section.
    b. Plate shall be manufactured using a premium grade polyester or vinyl ester resin with fire retardant additive to meet Class I flame rating of 25 or less as tested by ASTM E-84 and meet the self extinguishing requirements of ASTM D-635. All plate shall contain a U. V. inhibitor.
    c. Plate will be epoxy bonded to the grating, and a non-skid grit will be affixed to the top surface of the assembly by a baked epoxy resin, followed by a top coat of baked epoxy resin.

4. All cut and machined edges, holes and abrasions shall be sealed with a resin compatible with the resin matrix used in the bearing bars and cross rods.
5. All panels shall be fabricated to the sizes shown on the approved shop drawing.

2.3 STRUCTURAL SHAPES

A. Structural shapes shall be made from a premium grade polyester or vinyl ester resin with fire retardant additives to meet Class 1 flame rating of ASTM E-84 and meet the self-extinguishing requirements of ASTM D-635. All structural shapes shall contain a U.V. inhibitor.

B. Manufactured by the pultrusion process.

1. Structural FRP members composition shall consist of a glass fiber reinforced polyester or vinyl ester resin matrix, approximately 50% resin to glass ratio. A synthetic surface veil shall be the outermost layer covering the exterior surfaces. Continuous glass strand rovings shall be used internally for longitudinal strength. Continuous strand glass mats shall be used internally for transverse strength.

C. The following minimum mechanical properties shall apply:

Table 1 – Fiberglass Pultruded Material Properties
Minimum Ultimate Coupon Properties (UN)

Material Properties	ASTM Test Method	PSI (Mpa)
Pultruded Fiberglass Structural Shapes		
Ultimate tensile stress in longitudinal direction	D638	30,000 (207)
Ultimate compressive stress in longitudinal direction	D695	30,000 (207)
Ultimate flexural stress in longitudinal direction	D790	30,000 (207)
Ultimate short beam shear in longitudinal direction	D2344	4,500 (31)
Ultimate tensile stress in transverse direction	D638	7,000 (48)
Ultimate compressive stress in transverse direction	D695	15,000 (103)
Ultimate flexural stress in transverse direction	D790	10,000 (69)
Density (lb/in.^{3} (kg/mm^3)	D792	.060-.070 (0.00166-00194)
Water absorption (24-h immersion)	D570	0.60 Max., % by Weight
Barcol Hardness	D2583	45
Coefficient of thermal 10^{-}6 in/in/°C	D696	8
Expansion,LW10^{-6} in/in/°F	_____	4.4
Thermal conductivity BTU-in/FT^2/hr/°F	C177	4

Material Properties	ASTM Test Method	PSI (Mpa)
Flame Retardant Properties		
Flame resistance	FTMS 406-2023	55/30 lgn.burn.sec.
Flammability test	D 635	Self Extinguishing
Surface burning characteristics	E 84	25 maximum
Flammability class	UL 94	VO
Temperature index	UL94	130°C

2.4 HANDRAILS

A. Design:

1. The FRP handrail system shall be designed to meet the configuration and loading requirements of OSHA 1910.23, with a minimum factor of safety on loading of 2.0.

B. Material:

1. The rails and posts shall be 2"'x2"x.156" square tube manufactured by the pultrusion process. The kickplate shall be 4"xl/2" (corrugated) x .125" thick pultruded fiberglass shape. The parts may be coated with an industrial grade polyurethane paint for additional U.V. protection and wear resistance. The pultruded parts shall be made with a fire retardant resin which meets the ASTM E-84 test for a flame spread of 25 or less. The resin matrix shall be {polyester} or {vinyl ester} and shall contain a UV inhibitor. The color shall be {OSHA safety yellow} or {gray}.
2. The pultruded parts shall meeting the following minimum mechanical properties:

Properties	Test Method	Values
Tensile Stress	ASTM D638	30,000 psi
Tensile Modulus	ASTM D638	2.5×10^6 psi
Compressive Stress	ASTM D695	30,000 psi
Compressive Modulus	ASTM D695	2.5×10^6 psi
Flexural Stress	ASTM D790	30,000 psi
Flexural Modulus	ASTM D790	1.6×10^6 psi
Shear Stress	ASTM D2344	4,500 psi
Density	ASTM D792	.060 - .070 lbs/in^3
24 Hr. Water Absorption	ASTM D570	0.6% max
Coef. of Thermal Expansion	ASTM D696	4.4×10^{-6} in/in°F
Flexural Stress	Full Section	36,000 psi

Properties	Test Method	Values
Flexural Modulus	Full Section	3.7×10^6 psi

C. Fabrication Handrail System:

1. The fiberglass handrail system shall be fabricated into finished sections by fabricating and joining together the pultruded square tube using molded or pultruded components; epoxy bonded and connected as shown in the fabrication details. Where required by OSHA, fiberglass kickplate shall be attached to the handrail posts with nylon rivets. Handrail sections shall be fabricated to the size shown on the approved fabrication drawings and shall be piece marked with a waterproof tag.

D. For Side Mount:

1. Post shall be constructed with a square pultruded bottom plug. Length shall be sufficient to extend a minimum of one inch beyond the uppermost bolt hole to prevent cursing of post tubing. Bolt holes shall provide clearance of 1/16 inch for 1/2 inch diameter bolts/studs. Holes shall be on longitudinal center line of post, 1 inch from bottom of post (minimum) and not less than 3 inches apart on center. Posts shall be fastened with stainless steel anchor bolts or studs, 1/2 inch diameter extending no less than 2-1/4 inches into the concrete, or into a minimum thickness of 1/4 inch structural steel or pultruded fiberglass.
2. Post locations shall be no greater than 24 inches, nor less than 9 inches from horizontal or vertical change in handrail direction. Post centers shall be no greater than 72 inches apart on any straight run of rail or 48 inches apart on any inclined rail section.

E. Other Attachment Methods:

1. Base mount, embedded, and removable are also types of mounting procedures for handrail. Contact approved fabricator for detailed information on these connection types.

F. Installation of Handrail Sections:

1. The fabricated handrail sections shall be supplied complete with fittings by the FRP manufacturer. The components used to joint fabricated sections together may be shipped loose, to be exposed and riveted together in the filed by the Contractor, per the manufacturer's recommendations.
2. The fabricated handrail sections shall be installed as shown on the approved shop drawings. The handrail sections shall be accurately located, erected plumb and level. The sections shall be fastened to the structure as shown on the approved shop drawing.

G. Approved Fabricators:

1. Morrison Molded Fiber Glass Company (MMFG)

   a. AFC Division (Chatfield, MN)
   b. Bristol Division (Bristol, VA)

2. Approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

B. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.2 INSTALLATION, GENERAL

A. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, and other connectors as required.

B. Cutting, fitting, and placement: Perform cutting, drilling, and fitting required for installation of miscellaneous FRP fabrications. Set FRP fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

3.3 ALL FRP INSTALLATION

A. All field cut and drilled edges, holes and abrasions shall be sealed with a catalyzed resin compatible with the original resin as recommended by the manufacturer. The sealing of the edges shall prevent premature fraying at the field cut edges.

B. Install items specified as indicated and in accordance with manufacturer’s instructions.

3.4 INSPECTION AND TESTING

A. The Engineer shall have the right to inspect and test all materials to be furnished under these specifications prior to their shipment from the point of manufacture.

B. All labor, power, materials, equipment, and appurtenances required for testing shall be furnished by the Contractor at no cost to the Owner.

END OF SECTION 107455

DIVISION 22

PLUMBING

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SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Flexicraft.
2. Link Seal.
3. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

    a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves.

2. Exterior Concrete Walls below Grade:

    a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

    a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

    a. Piping Smaller Than NPS 6 (DN 150): PVC-pipe sleeves.

5. Interior Partitions:

    a. Piping Smaller Than NPS 6 (DN 150): PVC-pipe sleeves.

END OF SECTION 220517

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SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze ball valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and soldered ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for solder-joint connections.
6. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 4 (DN 100) and larger.
2. Handlever: For quarter-turn valves smaller than NPS 4 (DN 100).

H. Valves in Insulated Piping:

1. Include 2-inch (50-mm) stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRONZE BALL VALVES

A. One-Piece, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Conbraco Industries, Inc.
b. NIBCO INC.
c. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-110.
   b. CWP Rating: 400 psig (2760 kPa).
   c. Body Design: One piece.
   d. Body Material: Bronze.
   e. Ends: Threaded.
   f. Seats: PTFE.
   g. Stem: Bronze.
   h. Ball: Chrome-plated brass.
   i. Port: Reduced.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. One piece, bronze ball valve with bronze trim.

END OF SECTION 220523.12

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fiberglass pipe hangers.
2. Fiberglass strut systems.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe stands.
6. Pipe positioning systems.
7. Equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Fiberglass strut systems.
3. Pipe stands.
4. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
2. Hanger Rods: Continuous-thread rod, washer, and nuts made of fiberglass.

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.

2.2 FIBERGLASS STRUT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Allied Tube & Conduit; a part of Atkore International.
2. B-line, an Eaton business.
3. Champion Fiberglass, Inc.
4. Seasafe, Inc.; AMICO, a Gibraltar Industries Company.

B. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.

1. Channels: Continuous slotted fiberglass channel with inturned lips.
2. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of fiberglass.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Pipe Shields Inc.
2. Piping Technology & Products, Inc.
3. Rilco Manufacturing Co., Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece fiberglass base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: fiberglass.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.6 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

F. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

H. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

N. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

P. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
    c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
    d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
    e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use fiberglass pipe hangers and fiberglass strut systems and corrosion-resistant attachments for hostile environment applications.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).

J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

K. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

L. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

O. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

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SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Pittsburgh Corning Corporation.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Foster Brand; H. B. Fuller Construction Products.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Foster Brand; H. B. Fuller Construction Products.
    b. Knauf Insulation.
    c. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Foster Brand; H. B. Fuller Construction Products.
    b. Knauf Insulation.
    c. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller Construction Products.
    c. Vimasco Corporation.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
4. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Foster Brand; H. B. Fuller Construction Products.
    b. Mon-Eco Industries, Inc.
    c. Pittsburgh Corning Corporation.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
5. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Eagle Bridges - Marathon Industries.
    b. Foster Brand; H. B. Fuller Construction Products.
    c. Mon-Eco Industries, Inc.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Johns Manville; a Berkshire Hathaway company.
    b. P.I.C. Plastics, Inc.
    c. Proto Corporation.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Color-code jackets based on system. Color as selected by Architect.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Ideal Tape Co., Inc., an American Biltrite Company.

b. Knauf Insulation.
c. Venture Tape.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Ideal Tape Co., Inc., an American Biltrite Company.
b. Knauf Insulation.
c. Venture Tape.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.10 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ITW Insulation Systems; Illinois Tool Works, Inc.
b. RPR Products, Inc.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 316; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. C & F Wire.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. McGuire Manufacturing.
b. Plumberex Specialty Products, Inc.
c. Zurn Industries, LLC.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures,:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Truebro.
b. Zurn Industries, LLC.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular

surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm) wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.10 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.11 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.12 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.14 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.15 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 (DN 25) Insert pipe size and Smaller: Insulation shall be the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.

2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.

3.16 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Cellular Glass: 2 inches (50 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. All Pipe Sizes: Insulation shall be the following:

a. Cellular Glass: 2 inches (50 mm) thick.

3.17 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:

1. PVC: 30 mils (0.8 mm) thick.

3.18 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:

1. PVC: 30 mils (0.8 mm) thick.

END OF SECTION 220719

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SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

B. Related Requirements:

1. Section 221113 "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper-Tube, Extruded-Tee Connections:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. T-DRILL Industries Inc.

2. Description: Tee formed in copper tube according to ASTM F 2014.

H. Appurtenances for Grooved-End Copper Tubing:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Anvil International.
b. Shurjoint Piping Products.
c. Victaulic Company.

2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.
3. Mechanical Couplings for Grooved-End Copper Tubing:

    a. Copper-tube dimensions and design similar to AWWA C606.
    b. Ferrous housing sections.
    c. EPDM-rubber gaskets suitable for hot and cold water.
    d. Bolts and nuts.
    e. Minimum Pressure Rating: 300 psig (2070 kPa).

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Smith, Jay R. Mfg. Co.
    b. Smith-Blair, Inc.
    c. Viking Johnson.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Watts; a Watts Water Technologies company.
b. Wilkins.
c. Zurn Industries, LLC.

2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Watts; a Watts Water Technologies company.
b. Wilkins.
c. Zurn Industries, LLC.

2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Grinnell Mechanical Products.
b. Precision Plumbing Products.
c. Victaulic Company.

2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig (2070 kPa) at 225 deg F (107 deg C).
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

G. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

I. Install piping to permit valve servicing.

J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

K. Install piping free of sags and bends.

L. Install fittings for changes in direction and branch connections.

M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

N. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

O. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

I. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting.

Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

J. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

K. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Roll groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

M. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Piping: Join according to ASTM D 2855.

N. Joints for PEX Piping: Join according to ASTM F 1807.

O. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric couplings or nipples.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
6. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
7. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.

E. Install supports for vertical copper tubing every 10 feet (3 m).

F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
5. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
8. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.

G. Install supports for vertical steel piping every 15 feet (4.5 m).

H. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
5. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
8. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.

I. Install supports for vertical stainless-steel piping every 15 feet (4.5 m).

J. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
4. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
5. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
6. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

K. Install supports for vertical CPVC piping every 60 inches (1500 mm) for NPS 1 (DN 25) and smaller, and every 72 inches (1800 mm) for NPS 1-1/4 (DN 32) and larger.

L. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 (DN 25) and Smaller: 32 inches (815 mm) with 3/8-inch (10-mm) rod.

M. Install hangers for vertical PEX piping every 48 inches (1200 mm).

N. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 (DN 50) and Smaller: 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
5. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

O. Install supports for vertical PVC piping every 48 inches (1200 mm).

P. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
4. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
5. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
6. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

Q. Install supports for vertical PP piping every 60 inches (1500 mm) for NPS 1 (DN 25) and smaller, and every 72 inches (1800 mm) for NPS 1-1/4 (DN 32) and larger.

R. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.

b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, NPS 3 (DN 80) and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper, solder-joint fittings; and brazed joints.

E. Aboveground domestic water piping, NPS 2 (DN 50) and smaller, shall be[**one of**] the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- or wrought-copper, solder-joint fittings; and soldered joints.

3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
3. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

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SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Strainers.
6. Hose bibbs.
7. Wall hydrants.
8. Water-hammer arresters.
9. Air vents.
10. Flexible connectors.
11. Water Meters.

B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa) unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Ames Co.
   b. Watts; a Watts Water Technologies company.
   c. Zurn Industries, LLC.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze.

2.4 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Ames Co.
   b. Watts; a Watts Water Technologies company.
   c. Zurn Industries, LLC.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig (83 kPa) maximum, through middle third of flow range.
5. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
6. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.

7. Configuration: Designed for vertical flow.
8. Accessories:

    a. Valves NPS 2 (DN 50) and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 (DN 65) and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.5 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Honeywell Water Controls.
    b. Watts; a Watts Water Technologies company.
    c. Zurn Industries, LLC.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig (1035 kPa).
4. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

2.6 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. NIBCO INC.
    b. TACO Incorporated.
    c. Watts; a Watts Water Technologies company.

2. Type: Ball valve with two readout ports and memory-setting indicator.
3. Body: bronze.
4. Size: Same as connected piping, but not larger than NPS 2 (DN 50).
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.7 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:

    a. Strainers NPS 2 (DN 50) and Smaller: 0.033 inch (0.84 mm).

6. Drain: Factory-installed, hose-end drain valve.

2.8 HOSE BIBBS

1. See schedule for requirements.

2.9 WALL HYDRANTS

1. See schedule for requirements.

2.10 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Precision Plumbing Products.
    b. Watts; a Watts Water Technologies company.
    c. Zurn Industries, LLC.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows or Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.11 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig (860-kPa) minimum pressure rating at 140 deg F (60 deg C).
3. Float: Replaceable, corrosion-resistant metal.

4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 (DN 10) minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.12 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Flex Pression Ltd.
2. Tozen Corporation.
3. Universal Metal Hose.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

2.13 WATER METERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Model 55 Recordall Disc Meter as manufactured by Badger Meter or comparable product by one of the following:

1. Badger Meter
2. Mueller Co.
3. Sensus.

B. Description: Meters shall meet or exceed the most recent revision of AWWA C700 and be constructed of lead-free bronze alloy. The meters shall comply with the lead-free provisions of the Safe Drinking Water Act, shall be certified to NSF/ANSI Standards 61 and 372 and shall carry the NSF-61 mark on the housing.

C. Operating Performance: Water meters shall meet or exceed registration accuracy for the low flow rates (95%), normal operating flow rates (100 +/- 1.5%), and maximum continuous flow rates as specifically stated in AWWA C700

D. Construction: Meter construction, which shall comply with AWWA C700, shall consist of three basic components: meter housing, measuring chamber, and permanently sealed register or encoder.

E. Registers: A standard, sweep-hand register shall be provided with the water meter. The standard register shall be a straight-reading, permanently sealed magnetic drive register. The register shall have a six-odometer wheel totalization display, 360° test circle sweep hand, and flow finder to detect leaks. Register gearing shall be made of self-lubricating engineered polymer. The register capacity shall be 10,000,000 gallons.

F. Materials:

1. Meter Housing – Lead-free bronze alloy
2. Housing Bottom Plates – Cast iron, lead-free bronze alloy
3. Measuring Chamber – Engineered polymer
4. Disc – Engineered polymer
5. Trim – Stainless steel
6. Strainer – Engineered polymer
7. Disc Spindle – Stainless Steel
8. Magnet – Ceramic
9. Magnet Spindle – Stainless steel
10. Register Lid and Shroud – Engineered polymer, bronze

G. Operating Characteristics:

1. Size: 1-inch
2. Operating Range: 0.5 to 40 gpm
3. Pressure Loss: 3.4 psi at 40 gpm
4. Measuring Element: Nutating Disc, Positive Displacement.
5. Maximum Operating Temperature: 80°F
6. Maximum Operating Pressure: 150psi

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

C. Install balancing valves in locations where they can easily be adjusted.

D. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.

E. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking, wall reinforcement

between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

F. Install water-hammer arresters in water piping according to PDI-WH 201.

G. Install air vents at high points of water piping.

H. , and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Reduced-pressure-principle backflow preventers.
3. Water pressure-reducing valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each pressure vacuum breaker an dreduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

END OF SECTION 221119

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Flow-control, electric, tankless, domestic-water heaters.
2. Thermostat-control, electric, tankless, domestic-water heaters.
3. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of tankless, electric, domestic-water heater, from manufacturer.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. ETL Listing: UL 499, “Standard for Electric Heating Appliances” & UL 50E, “Enclosures for Electrical Equipment, Environmental Considerations.”

E. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components – Health Effects" and NSF 372, “Drinking Water System Components – Lead Content.”

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Electric, Tankless, Domestic-Water Heaters: Five year(s).

PART 2 - PRODUCTS

2.1 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS

A. Thermostat-Control, Electric, Tankless, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Keltech, Inc.

b. E-Tankless Water Heaters Corp.

2. Standard: UL 499 for electric, tankless, (domestic-water heater) heating appliance.
3. Construction: Copper piping or tubing complying with NSF 61 Annex G barrier materials for potable water, without storage capacity.

   a. Connections: ASME B1.20.1 pipe thread.
   b. Casing: 316 Stainless Steel, NEMA 4X.
   c. Pressure Rating: 150 psig (1035 kPa).
   d. Heating Element: Low watt density, incoloy 800 sheathed resistive element.

4. Options:

   a. Emergency stop button.
   b. Door cutoff switch.
   c. Internal Fused Disconnect.
   d. Ground Fault Protection: senses leakage current to ground >1 Amp. In the event a fault is detected, this device will terminate the high voltage power supply to heating elements and disable operation of the unit. Fault status is communicated at the control interface. Personnel may also test the Ground Fault system and reset any nuisance trips without opening the cabinet.
   e. Alarm: Local audible and visual alarm on the heater and dry contacts that open to signal a flow greater than 1.5 gpm.

5. Temperature Control: Thermostat with infinitely variable PID temperature controller.

   a. Activation: Dual Flow (eye/face wash and shower).
   b. Controller-locked temperature setting, output fixed at 80°F (27°C)

6. Safety Control:

   a. Three-tier anti-scald protection and hot water evacuation (overshoot purge protection). The controller alarm sends a signal to disconnect power to the elements if the temperature reaches 90°F (32°C). The internal thermostat with auto reset high limit switch ensures that when the temperature limit is reached, the unit will power down a bank of elements; when the temperature returns to the set point, power is restored. The surface mounted bi-metal thermostat with manual reset acts as a fail-safe and must be manually reset before power can be restored to the elements if the temperature limit is exceeded.
   b. TepidGuard™ is an anti-scald feature, standard on all SNA-Series Safety Shower Heaters. This overshoot purge will automatically open and purge excess temperature water. This feature actively monitors temperature within the heater while operational. It also passively monitors water temperature while the heater is inactive.
   c. Temperature Safety Values:

      1) Internal thermostat with auto reset high limit switch: 95°F (35°C)
      2) Surface mounted bi-metal thermostat with manual reset: 100°F (38°C)
      3) Overshoot purge: 95°F (35°C).

7. Capacity and Characteristics: See plans.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

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~~B. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.~~

B. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

C. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

D. Strainer: Y-pattern, stainless steel.

E. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches (457 mm) above the floor.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters on concrete base, 4-inches larger than unit footprint in all dimensions. Comply with requirements for concrete bases specified in Section 033100 "Cast-in-Place Concrete.".

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

C. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

E. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

F. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

G. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

H. Fill electric, domestic-water heaters with water.

I. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain tankless, electric, domestic-water heaters.

END OF SECTION 223300

SECTION 224500 - EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Emergency showers.
2. Combination units.
3. Supplemental equipment.
4. Water-tempering equipment.

1.3 DEFINITIONS

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

C. Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid-solution supply.

D. Tepid: Moderately warm.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For emergency plumbing fixtures to include in operation and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushing-Fluid Solution: Separate lot and equal to at least 200 percent of amount of solution installed for each self-contained unit.

1.8 QUALITY ASSURANCE

A. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

B. NSF Standard: Comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.

C. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

PART 2 - PRODUCTS

2.1 COMBINATION UNITS

A. Accessible, Plumbed Emergency Shower with Eye/Face Wash Combination Units,:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Acorn Safety.
b. Bradley Corporation.
c. Guardian Equipment Co.
d. Speakman Company.

2. Piping:

a. Material: PVC.
b. Unit Supply: NPS 1-1/2 (DN 40).
c. Unit Drain: Outlet at back or side near bottom.

3. Shower:

a. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
b. Supply Piping: NPS 1 (DN 25) with flow regulator and stay-open control valve.
c. Control-Valve Actuator: Pull rod.
d. Shower Head: 8-inch- (200-mm-) minimum diameter, plastic.
e. Mounting: Pedestal.

4. Eye/Face Wash Unit:

   a. Capacity: Not less than 3 gpm (11.4 L/min.) for at least 15 minutes.
   b. Supply Piping: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
   c. Control-Valve Actuator: Paddle.
   d. Spray-Head Assembly: Two or four receptor-mounted spray heads.
   e. Receptor: Plastic bowl.
   f. Mounting: Attached to shower pedestal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Section 221116 "Domestic Water Piping."

E. Install thermometers in supply and outlet piping connections to water-tempering equipment. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

F. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Fill self-contained fixtures with flushing fluid.

3.3 CONNECTIONS

A. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for cold-water piping specified in Section 221116 "Domestic Water Piping".

B. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.4 IDENTIFICATION

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Emergency plumbing fixtures will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION 224500

DIVISION 23

HEATING, VENTILATING, AND AIR CONDITIONING

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SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

2. Balancing steam systems.
3. Testing, Adjusting, and Balancing Equipment:

a. Motors.

4. Testing, adjusting, and balancing existing systems and equipment.
5. Control system verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:

    a. The Contract Documents examination report.
    b. The TAB plan.
    c. Needs for coordination and cooperation of trades and subcontractors.
    d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 60 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 60 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. System Readiness Checklists: Within 60 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC, NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC, NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by AABC, NEBB or TABB as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.7 FIELD CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

I. Examine operating safety interlocks and controls on HVAC equipment.

J. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Automatic temperature-control systems are operational.
g. Ceilings are installed.
h. Windows and doors are installed.
i. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation,"

Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

   a. Measure static pressure directly at the fan outlet or through the flexible connection.
   b. Measure static pressure directly at the fan inlet or through the flexible connection.
   c. Measure static pressure across each component that makes up the air-handling system.
   d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.6 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.7 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.8 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate-drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.9 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.10 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.11 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Balancing stations.
4. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches (mm), and bore.
i. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Filter static-pressure differential in inches wg (Pa).
f. Cooling-coil static-pressure differential in inches wg (Pa).
g. Heating-coil static-pressure differential in inches wg (Pa).
h. Outdoor airflow in cfm (L/s).
i. Return airflow in cfm (L/s).
j. Outdoor-air damper position.
k. Return-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch (mm) o.c.
f. Make and model number.
g. Face area in sq. ft. (sq. m).
h. Tube size in NPS (DN).
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm (L/s).
b. Average face velocity in fpm (m/s).
c. Air pressure drop in inches wg (Pa).
d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig (kPa).
j. Refrigerant suction temperature in deg F (deg C).

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h (kW).
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm (L/s).
i. Face area in sq. ft. (sq. m).
j. Minimum face velocity in fpm (m/s).

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h (kW).
b. Airflow rate in cfm (L/s).
c. Air velocity in fpm (m/s).
d. Entering-air temperature in deg F (deg C).
e. Leaving-air temperature in deg F (deg C).
f. Voltage at each connection.
g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and size.
    e. Manufacturer's serial number.
    f. Arrangement and class.
    g. Sheave make, size in inches (mm), and bore.
    h. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches (mm), and bore.
    f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
    g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm (L/s).
    b. Total system static pressure in inches wg (Pa).
    c. Fan rpm.
    d. Discharge static pressure in inches wg (Pa).
    e. Suction static pressure in inches wg (Pa).

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

    a. System and air-handling-unit number.
    b. Location and zone.
    c. Traverse air temperature in deg F (deg C).
    d. Duct static pressure in inches wg (Pa).
    e. Duct size in inches (mm).
    f. Duct area in sq. ft. (sq. m).
    g. Indicated airflow rate in cfm (L/s).
    h. Indicated velocity in fpm (m/s).
    i. Actual airflow rate in cfm (L/s).
    j. Actual average velocity in fpm (m/s).
    k. Barometric pressure in psig (Pa).

J. Instrument Calibration Reports:

1. Report Data:

    a. Instrument type and make.

b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.12 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect.

B. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, Owner or Architect may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.13 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

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SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Sheet metal materials.
3. Sealants and gaskets.
4. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:
1. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.

7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 316,cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

C. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.4 HANGERS AND SUPPORTS

A. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports:

1. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

J. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Duct system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.8 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

A. Fabricate ducts with stainless steel 316

B. Supply Ducts:

1. Ducts Connected to Heat Pumps:

a. Pressure Class: Positive 1-inch wg (250 Pa).
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 24.

C. Return Ducts:

1. Ducts Connected to Heat Pumps:

a. Pressure Class: Positive or negative 1-inch wg (250 Pa).
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 24.

D. Intermediate Reinforcement:

1. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

E. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

F. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.

END OF SECTION 233113

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SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Louver face diffusers.
2. Louvered face grilles.

B. Related Sections:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

PART 2 - PRODUCTS

2.1 DIFFUSERS

A. Louver Face Diffuser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Carnes Company.
b. Price Industries.
c. Titus.

2. Material: stainless steel.
3. Mounting: Surface.
4. Pattern: Two-way core style.

2.2 REGISTERS AND GRILLES

A. Louvered Face Grille:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Carnes Company.
b. Price Industries.
c. Titus.

2. Material: stainless steel.
3. Pattern: one way
4. Mounting: surface

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

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SECTION 238113.13 - PACKAGED TERMINAL AIR-CONDITIONERS, OUTDOOR, WALL-MOUNTED UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes packaged, terminal, outdoor, wall-mounted air conditioners.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For packaged, terminal air conditioners.

1. Include plans, elevations, sections, details for wall penetrations, and attachments to other work.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Color Samples: For unit cabinet, discharge grille, and exterior louver, and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For packaged, terminal air conditioners, for tests performed by manufacturer and witnessed by a qualified testing agency.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged, terminal air conditioners to include in emergency, operation, and maintenance manuals.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of packaged, terminal air conditioners that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Sealed Refrigeration System: Manufacturer's standard, but not less than five years from date of Substantial Completion, including components and labor.
2. Warranty Period for Nonsealed System Parts: Manufacturer's standard, but not less than five years from date of Substantial Completion, including only components and excluding labor.
3. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.
4. Warranty Period for Energy Recovery Ventilator: : Manufacturer's standard, but not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Bard Manufacturing Company.
2. Liebert; a brand of Emerson Electric Co.
3. Marvair.

2.2 MANUFACTURED UNITS

A. Description: Factory-assembled and -tested, self-contained, packaged, terminal air conditioner with room cabinet, electric refrigeration system, heating, and temperature controls; fully charged with refrigerant and filled with oil; with hardwired chassis and circuit breaker.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."

D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

E. ASHRAE Thermal Comfort: Applicable requirements in ASHRAE 55.

F. ASHRAE ERV Testing: Applicable requirements in ASHRAE 84.

G. AHRI Rating: Applicable requirements in AHRI 1060.

H. UL listed and ETL performance certified.

2.3 CHASSIS

A. Cabinet: Sloped top, 0.052-inch- (1.32-mm-) thick stainless steel with removable front panel with concealed latches.

1. Mounting: On exterior wall.
2. Discharge Grille: Stainless Steel.
3. Return Grille: Stainless Steel.
4. Louvers: Stainless Steel.
5. Finish: Stainless Steel.
6. Access Door: Hinged door in top of cabinet for access to controls.
7. Cabinet Extension: Matching cabinet in construction and finish, allowing diversion of airflow to adjoining room; with grille.
8. Insulation: Cooling and heating sections fully insulated with 1-inch (25-mm)-thick fiberglass insulation.
9. Finish of Interior Surfaces: Surfaces in contact with the airstream shall be coated with phenolic resin.
10. Wall Sleeves: Molded fiberglass-reinforced polyester.

B. Refrigeration System: Direct-expansion indoor coil with capillary restrictor and hermetically sealed, soft-start scroll compressor with crankcase heater, liquid line filter dryer, externally equalized expansion valve, high-pressure switch, low-pressure switch, low-pressure bypass timer, fan cycle, control, lockout relay, common alarm, vibration isolation, and overload protection.

1. Indoor and Outdoor Coils: Seamless copper tubes mechanically expanded into aluminum fins with capillary tube distributor on indoor coil.
2. Accumulator.
3. Constant-pressure expansion valve.
4. Reversing valve.
5. Charge: R-410A.

C. Indoor Fan: Forward curved, centrifugal; with variable-speed ECM motor and positive-pressure ventilation damper with electric operator.

D. Filters: 2-inch (25-mm), pleated, disposable MERV 6, serviceable from front of the unit.

E. Condensate Drain: Stainless-steel drain pan.

F. Outdoor Fan: Forward curved, centrifugal, or propeller type motor.

G. Energy Recovery Wheel:

1. Casing: Steel with standard factory-painted finish.
2. Casing seals on periphery of rotor and on duct divider.
3. Support vertical rotors on grease-lubricated ball bearings having extended grease fittings or permanently lubricated bearings. Support horizontal rotors on tapered roller bearing.
4. Rotor: Polymer segmented wheel strengthened with radial spokes impregnated with nonmigrating, water-selective, molecular-sieve desiccant coating.

5. Drive: Fractional horsepower motor, gear reducer, and self-adjusting multilink belt around outside of rotor.

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    b. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

6. Controls: Starting relay, factory mounted and wired, and manual motor starter for field wiring.

2.4 HEATING

A. Electric-Resistance Heating Coil: Nickel-chromium-wire, electric-resistance heating elements with contactor and high-temperature-limit switch.

2.5 CONTROLS

A. Control Module: Unit-mounted digital panel with touchpad temperature control and with touchpad for heating, cooling, and fan operation. Include the following features:

1. Low-Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg F (5 deg C) outdoor air temperature.
2. Heat-Pump Ambient Control: Field-adjustable switch changes to heat-pump heating operation above 40 deg F (5 deg C) and to supplemental heating below plus 25 deg F (minus 4 deg C).
3. Building Automation System Interface: Allows remote on-off control with setback temperature control.
4. Reverse-Cycle Defrost: Solid-state sensor monitors frost buildup on outdoor coil and reverses unit to melt frost.

B. Remote Control: Standard unit-mounted controls with remote-mounted, low-voltage, adjustable thermostat with heat anticipator; heat-off-cool-auto switch; and on-auto fan switch.

C. Outdoor Air: Motorized intake damper. Open intake when unit indoor-air fan runs.

D. Economizer Operation: Motorized intake-air damper controlled by an enthalpy sensor and a mixed-air sensor to provide natural cooling when the outdoor air temperature is favorable.

E. Dual Unit Control (DUC): Hinged cover with two-stage heat/cool thermostat with individual heat/cool setpoints, adjustable interstage differentials and bimetallic elements. The control shall feature a solid-state timer with 1-2-4-8 day sequence, unit lead selector, Unit 1 and 2 power-on LEDs, Unit 1 or 2 lead unit LEDs, 48-hour program save on loss of power, industry standard connections, and 24-volt power from each unit. The DUC shall provide auto sequencing and displays on status and operating status parameters.

F. Three-Phase Power Rotation Monitor: Three-phase monitoring to protect compressor from reverse rotation and to protect the unit from phase failure. Monitor manually reset.

G. Ventilation:

1. Extra Ventilation: Section internally mounted, allowing up to 50% outside air and exhaust air through the action of adjustable dampers.
2. Energy Recovery Ventilator: Rotary washable desiccant wheel(s), insulated cassette frame with seals, three-speed drive motor and belt, and intake and exhaust blowers.

H. Dehumidification Circuit: Supply-air stream, independent heat exchanger using a separate humidistat, hot gas three-way valve, separate desuperheating condenser circuit, and back drain orifice inserted between the reheat coil and suction line.

2.6 CAPACITIES AND CHARACTERISTICS: See Plans

2.7 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Factory test to comply with AHRI 300, "Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment."

B. Unit Performance Ratings: Factory test to comply with AHRI 310/380/CSA C744, "Packaged Terminal Air-Conditioners and Heat Pumps."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.

B. Install wall sleeves in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Section 079200 "Joint Sealants."

3.2 CONNECTIONS

A. Install piping adjacent to machine to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Inspect for and remove shipping bolts, blocks, and tie-down straps.

2. After installing packaged, terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
3. Unit is level on base and is flashed in exterior wall.
4. Unit casing has no visible damage.
5. Compressor, air-cooled condenser coil, and fans have no visible damage.
6. Labels are clearly visible.
7. Controls are connected and operable.
8. Shipping bolts, blocks, and tie-down straps are removed.
9. Filters are installed and clean.
10. Drain pan and drain line are installed correctly.
11. Electrical wiring installation complies with manufacturer's submittal and installation requirements in electrical Sections.
12. Installation: Perform startup checks according to manufacturer's written instructions, including the following:

    a. Lubricate bearings on fan.
    b. Check fan-wheel rotation for correct direction without vibration and binding.

13. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
14. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. After performance test, change filters.

E. Packaged, terminal air conditioners will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust initial temperature set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged, terminal air conditioners.

END OF SECTION 238113.13

DIVISION 26

ELECTRICAL

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SECTION 260000 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 CONTRACTOR'S UNDERSTANDING

A. Contractors bidding work under this Contract shall read and understand Division 00 and Division 01 - General Requirements. If any discrepancies are discovered between the Basic Electrical Materials and Methods and General Requirements, the above mentioned documents shall overrule this section. The Basic Electrical Materials and Methods are intended as a supplement to the above mentioned documents.

B. The Contractor shall bid as outlined in the above mentioned Specifications and shall be governed by any alternates or unit prices called for in the form of proposal.

C. Each Contractor bidding on the work included in these Specifications shall view the building site and carefully examine the contract Drawings and Specifications, so that it may fully understand what is to be done, and to document existing conditions.

1.2 SCOPE OF WORK

A. Work included in this section of the Specifications shall include the furnishing of all labor, material, tools, approvals, excavation, backfill, and other equipment necessary to install the electrical system as shown on the Contract Drawings and as specified herein.

B. It also includes installation and connection of all electrical utilization equipment included in this Contract but furnished by other contractors or suppliers.

C. It is the general intent that all motors shall be furnished with the particular object of equipment it drives.

D. The Contractor shall furnish and install all conduit, wire, disconnect switches and miscellaneous material to make all electrical connections to all items of utilization equipment or wiring devices except as otherwise specified.

E. Equipment connections shall be made with flexible or rigid conduit as required. Controllers for motors, disconnect switches, and all control, protective and signal devices for motor circuits, except where such apparatus is furnished mounted and connected integrally with the motor driven equipment, shall be installed, connected and left in operating condition. The number and size of conductors between motors and control or protective apparatus shall be as required to obtain the operation described in these Specifications, and/or by the Contract Documents, and/or as shown in manufacturer furnished, Engineer reviewed Shop Drawings.

F. All devices and items of electrical equipment, including those shown on the Contract Drawings but not specifically mentioned in the Specifications or those mentioned in the Specifications but not shown on the Contract Drawings, are to be furnished under this section of the specifications. Any such device or item of equipment, if not defined in quality, shall be equal to similar Equipment and/or devices specified herein.

G. All devices and items of equipment mentioned in this section of the Specifications whether electrical or not or whether furnished under this or other Division of the Specifications, shall be installed under this Division of the Specifications, unless specifically indicated otherwise.

H. Where wiring diagrams are not shown on the Contract Drawings, they are to be provided by the supplier of the equipment served and such diagrams shall be adhered to except as herein modified.

I. The following is a list of items that may not be defined clearly on the Contract Drawings or in other parts of these Specifications. The list is meant to be an aid to the Contractor and is not necessarily a complete list of all work to be performed under this Contract:

1. Connect all motors and accessories furnished by equipment suppliers.
2. Furnish, install, and connect all motor controls.
3. Furnish, install, and connect lighting, indoor and outdoor.
4. Furnish, install, and connect power and signal lines to all instrumentation equipment, and accessories.
5. Furnish, install, and connect all electrical conduit, duct and cables.
6. Furnish, install, and connect all power distribution equipment.
7. Furnish and install security system devices and wiring (integrate with existing system).
8. Furnish and install access control system devices and wiring (integrate with existing system).
9. All HVAC control wiring is by the Temperature Controls Contractor for Division 23.

J. All raceways and wiring shall be fire stopped where required by code and/or indicated in the Contract Drawings, as specified in Section 078400.

1.3 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted in the amount of 8 copies for this Division. All Shop Drawings shall be submitted in loose-leaf three-ring cardboard reinforced vinyl binders.

B. Shop Drawings shall be submitted on the following materials specified in this Division:

1. Conduit - all types and sizes, including liquid-tight flexible.
2. Boxes - all types and sizes.
3. Coal tar epoxy paint.
4. Wiring devices.
5. Device plates.
6. Metal framing system (Strut type channel).
7. Conduit fittings, expansion joints, support hardware.
8. Motor control equipment (individually mounted items)
9. Power distribution equipment (individually mounted items).
10. Wire - all types and sizes.
11. Light fixtures - all types.
12. Wire markers, signs and labels.
13. Lightning/transient suppressors.
14. Transformers.

15. Security System equipment.
16. Access Control System equipment.

C. The Engineer reserves the right to make modifications to motor control and power distribution equipment ratings after Shop Drawing review, if the Shop Drawings are submitted prematurely (prematurely meaning submitted before all utilization equipment has been reviewed and accepted). Cost of modifications shall be the Contractor's responsibility.

1.4 SYMBOLS AND ABBREVIATIONS

A. The symbols and abbreviations general follow standard electrical and architectural practice; however, exceptions to this shall be as shown on the Contract Drawings.

1.5 COORDINATION WITH OTHER TRADES

A. The Contractor shall coordinate the electrical work with that of other trades to ensure proper final location of all electrical equipment and/or connections. The Contractor shall verify door swings to see that light switches are located properly.

1.6 CODES

A. The minimum standard for all work shall be the latest revision of the Kentucky Building Code (KBC), and the National Electrical Code (NEC). Whenever and wherever state and/or local laws or ordinances and/or regulations and/or the Engineer's design require a higher standard that the current NEC or KBC, then these laws and/or regulations and/or the design shall be followed.

B. Following is a list of other applicable Standards or Codes:

1.	Kentucky Building Code	KBC
2.	National Electrical Code	NEC
3.	National Electrical Safety Code	NESC
4.	Underwriters Laboratories, Inc.	UL
5.	Factory Mutual System	FM
6.	National Fire Protection Association	NFPA
7.	National Electrical Manufacturers Association	NEMA
8.	Occupational Safety and Health Administration	OSHA
9.	Insulated Cable Engineers Association, Inc.	ICEA
10.	Illuminating Engineering Society of North America	IES
11.	Instrument Society of America	ISA
12.	Institute of Electrical and Electronic Engineers, Inc.	IEEE
13.	Certified Ballast Manufacturers Association	CBM
14.	American National Standards Institute, Inc.	ANSI
15.	Anti-Friction Bearing Manufacturers Association, Inc.	AFBMA
16.	Joint Industry Council	JIC

17.	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.	ASHRAE
18.	Federal Communications Commission	FCC
19.	American Society for Testing and Materials	ASTM
20.	American Wood Preservers Association	AWPA
21.	Rural Electrification Association	REA

1.7 INSPECTIONS AND PERMITS

A. Inspection of the electrical system on all construction projects is required. If the local government has appointed a state licensed inspector, the Contractor shall be required to use that person to perform the inspections. If a locally mandated inspector does not exist, the Contractor shall select and hire a state licensed inspector, who has jurisdiction before any work is concealed. The Contractor shall notify the electrical inspector in writing, immediately upon notice to proceed, and a copy of the notice shall be submitted to the Engineer.

B. At the time of completion of the project, there shall be furnished to the Owner a certificate of compliance, from the agency having jurisdiction pursuant to all electrical work performed. The Engineer shall also receive a copy.

C. All costs incurred by the Contractor to execute the above mentioned requirements shall be paid by the Contractor at no extra cost to the Owner.

D. All permits necessary for the complete electrical system shall be obtained by the Contractor from the authorities governing such work. For further information, see Division 01.

1.8 STORAGE

A. All work, equipment, and materials shall be protected against dirt, water, or other injury during the period of construction.

B. Sensitive electrical equipment such as light fixtures, motor starters, controls, and panel boards, delivered to the job site, shall be protected against injury or corrosion due to atmospheric conditions or physical damage by other means. Protection is interpreted to mean that equipment shall be stored under roof, in a structure properly heated in cold weather and ventilated in hot weather. Provision shall be made to control the humidity in the storage area to 50 percent relative. The stored equipment shall be inspected periodically, and if it is found that the protection is inadequate, further protective measures shall be employed. Electrical equipment other than boxes and conduit shall not be installed until the structure is under roof with doors and windows installed.

C. No light fixtures or device plates shall be hung or installed until after painting is completed; however, temporary lighting shall be provided by the Contractor.

1.9 MATERIALS

A. All materials used shall be new and at least meet the minimum standards as established by the NEC and/or National Electrical Manufacturers Association (NEMA). All materials shall be UL listed for the application, where a listing exists. Additional requirements are found in Division 01. All equipment shall meet applicable FCC requirements and restrictions.

B. The material and equipment described herein has been specified according to a particular trade name or make to set quality standards. However, each Contractor has the right to substitute other material and equipment in lieu of that specified, other than those specifically mentioned at matching or for standardization, providing such material and equipment meets all of the requirements of those specified and is accepted, in writing by the Engineer.

C. The reuse of salvaged electrical equipment and/or wiring will not be permitted unless specified herein or indicated on the Contract Drawings.

D. All salvaged or abandoned electrical materials shall become the property of the {Owner} Contractor and shall be removed from the job site upon completion of the project, unless otherwise noted on the Contract Drawings or specified herein.

1.10 ERRORS, CORRECTIONS, AND/OR OMISSIONS

A. Should a piece of utilization equipment be supplied of a different size or horsepower than shown on the Contract Drawings, the Contractor shall be responsible for installing the proper size wiring, conduit, starters, circuit breakers, etc., for proper operation of that unit and the complete electrical system at no extra cost to the Owner.

B. It is the intent of these Specifications to provide for an electrical system installation complete in every respect, to operate in the manner and under conditions as shown in these Specifications and on the Contract Drawings. The Contractor shall notify the Engineer, in writing, of any omission or error at least 10 days prior to opening of bids. In the event of the Contractor's failure to give such notice, it may be required to correct work and/or furnish items omitted without additional cost. Further requirements on this subject may be found in the General Requirements, Division 01.

C. Necessary changes or revisions in electrical work to meet any code or power company requirement shall be made by the Contractor without additional charge.

1.11 GUARANTEES AND WARRANTIES

A. The Contractor shall guarantee all work including equipment, materials, and workmanship. This guarantee shall be against all defects of any of the above and shall run for a period of 1 year from the date of acceptance of the work, concurrent with the one year guarantee period designated for the general construction contract under which electrical work is performed. Date of acceptance shall be considered to be the date on which all "punch list" items are completed ("punch list" is defined to be the written listing of work that is incomplete or deficient that must be finished or replaced/repaired before the Contractor receives final payment).

B. Repair and maintenance for the guarantee period is the responsibility of the Contractor and shall include all repairs and maintenance other than that which is considered as routine. (That is oiling, greasing, etc.) The Engineer shall be the judge of what shall be considered as routine maintenance.

C. Lamps shall bear the manufacturer's warranty.

1.12 TESTING

A. After the wiring system is complete, and at such time as the Engineer may direct, the Contractor shall conduct an operating test for acceptance. The equipment shall be demonstrated to operate in accordance with the requirements of these Specifications and the Contract Drawings. The test shall be performed in the presence of the Engineer or its authorized representative. The Contractor shall furnish all instruments and personnel required for the tests, as well as the necessary electrical power.

B. Before energizing the system, the Contractor shall check all connections and set all relays and instruments for proper operation. It shall obtain all necessary clearances, approvals, and instructions from the serving utility company and/or equipment manufacturers prior to placing power on the equipment.

C. Tests may be performed by the Engineer to determine integrity of insulation on wiring circuits selected by the Engineer at random.

D. Cost of utilities for testing done prior to beneficial occupancy by the Owner shall be borne by the Contractor.

1.13 CLEANUP

A. Cleanup shall be completed as soon as possible after the electrical installation is complete. All light fixtures, outlets, switches, starters, motor controls, disconnect switches and other electrical equipment shall be free of shipping tags, stickers, etc. All painted equipment shall be left free of scratches or other blemishes, such as splattered or blistered paint, etc. All light fixture diffusers shall be clean and the interior of all motor controls, etc., shall be free of dust, dirt, wire strippings, etc. Surplus material, rubbish and equipment resulting from the work shall be removed from the job site by the Contractor upon completion of the work.

B. During construction, cover all Owner equipment and furnishings subject to mechanical damage or contamination in any way.

1.14 CUTTING AND PATCHING

A. Cutting and patching shall be held to an absolute minimum and such work shall be done only under the direction of the Engineer or Owner. The Contractor shall be responsible for and shall pay for all openings that may be required in the floors or walls, and it shall be responsible for putting said surfaces back in their original condition. Every attempt shall be made to avoid cutting reinforcing steel bars when an opening is required in a reinforced concrete wall or floor slab.

1.15 EXCAVATION AND BACKFILL

A. Excavation

1. Excavation for conduits shall be of sufficient width to allow for proper jointing and alignment of the type conduit used. Conduit shall be bedded on original ground. Where conduit is in solid rock, a 6 inch earth cushion must be provided. Conduit shall be laid in straight lines between pull boxes and/or structures unless otherwise notes on the Contract Drawings. The cost of solid rock excavation shall be included in the lump sum bid with no extra pay allowed (unclassified).

B. Backfill

1. Backfill shall be hand placed, loose granular earth for a height of 6 inches above the top of the largest conduit. This material shall be free of rocks over 2 inches in diameter. Above this, large rocks may be included but must be mixed with sufficient earth to fill all voids.

1.16 SLEEVES, CHASES AND OPENINGS

A. Sleeves shall be required at all points where exposed conduits pass through new concrete walls, slabs, or masonry walls. Sleeves that must be installed below grade or where subject to high water conditions must be installed watertight.

B. Wiring chases shall be provided where shown on the Contract Drawings. The Contractor shall have the option of installing chases below surface mounted panel boards provided all structural requirements are met.

C. It is the Contractor's responsibility to leave openings to allow installation of the complete, operational electrical system. Openings required but not left shall be cut as outlined under cutting and patching. The Contractor shall coordinate all holes and other openings with necessary diameters for proper fire stopping.

1.17 TEMPORARY ELECTRICAL POWER

A. The Contractor shall be responsible for providing temporary electrical power as required during the course of construction and shall remove the temporary service equipment when no longer required. Temporary power is also addressed in Division 01.

1.18 OVERCURRENT PROTECTION

A. Circuit breakers or fused switches shall be the size and type as written herein and shown on the Contract Drawings. Any additional overcurrent protection required to maintain an equipment listing by an authority having jurisdiction shall be installed by the Contractor at no extra cost to the Owner.

B. The Contractor shall submit to the Engineer actual nameplate data from motors shipped to the site, stating motor identification as well as characteristics. Overload relay thermal unit selection

tables shall accompany the motor data. The Engineer will select thermal unit sizes from this data for use by the Contractor in ordering proper thermal units.

1.19 AS BUILT DRAWINGS

A. The Contractor shall maintain 1 set of the Contract Drawings on the job in good condition for examination at all times. The Contractor's qualified representative shall enter upon these drawings, from day to day, the actual "as-built" record of construction and/or alteration progress. Entries and notes shall be made in a neat and legible manner and these drawings delivered to the Engineer after completion of the construction, for use in preparation of Record Drawings.

1.20 MAINTAINING CONTINUOUS ELECTRICAL SYSTEM AND SERVICE

A. Existing service(s) continuity shall be maintained at all times. In no way shall the installation and/or alteration of the electrical work interfere with or stop the normal operation of the existing pump station facilities, except where prior arrangements have been made

B. When additions and taps to existing service(s) require electrical outages of any duration, arrangements shall be made in advance for such outages. All outages shall be held to an acceptable minimum with none exceeding 8 hours continuous duration. If necessary, cuts shall be performed on premium time. If performed at night, requiring a general outage, the Contractor shall furnish an auxiliary source of light and power as required. Under no circumstances shall an electrical outage of any duration be initiated until the Owner and Engineer have concurred, and as far as possible in advance.

1.21 GROUNDING AND BONDING

A. All metallic conduit, cabinets, equipment, and service shall be grounded in accordance with the latest issue of the National Electrical Code. All supporting framework and other metal or metal clad equipment or materials which are in contact with electrical conduit, cable and/or enclosures shall be properly grounded to meet the code requirements.

1.22 RELATED SPECIFICATION DIVISIONS

A. The following divisions contain Specifications on utilization equipment, equipment accessories, and procedures related to execution of the electrical work, and are included here for the Contractor's information. Bids shall still be based on complete Contract Documents.

Division 00 – Procurement and Contracting Requirements
Division 01 – General Requirements
Division 02 – Existing Conditions
Division 03 – Concrete
Division 05 – Metals
Division 06 – Wood Plastics and Composites
Division 07 – Thermal and Moisture Protection
Division 08 – Openings

Division 09 – Finishes
Division 10 – Specialties
Division 23 – Heating, Ventilating, and Air Conditioning
Division 31 – Earthwork
Division 32 – Exterior Improvements
Division 33 – Utilities
Division 43 – Process Gas and Liquid Handling, Purification and Storage Equipment
Division 46 – Water and Wastewater Equipment

1.23 CONTRACTOR LICENSING

A. The Contractor performing the electrical work on this project shall be locally licensed, if required by local law or ordinance. If the Contractor has passed the State test, it may not be necessary to meet local testing requirements. It shall be the Contractor's responsibility to investigate these requirements and comply with same.

1.24 ANCHORING/MOUNTING

A. Electrical conduits and/or equipment shall be rigidly supported. Anchors used shall be metallic expansion type, or if appropriate to prevent spalling concrete, epoxy set type. Plastic or explosive type anchors are prohibited.

B. The Contractor shall ensure that all supports are consistent with the KBC requirements in this regard to Seismic Bracing.

1.25 ELECTRICAL COMPONENT MOUNTING HEIGHTS

A. Unless otherwise indicated, mounting height for components shall be as defined herein. In cases of conflicts with architectural or structural aspects, the components may be relocated. If an indicated height conflicts with a code requirement, the code shall govern.

B. Mounting heights are given from finished floor elevation to the centerline of the component, unless otherwise noted.

	Component	Height	Comments
1.	Wall type light switch	4'-0"	To top of box
2.	Low wall outlet	16"	To bottom
3.	Medium height wall outlet	44"	To bottom
4.	Wall type buzzers, horns, etc.	8'-0" Max.	Top 2" below ceiling
5.	Wall type exit signs	8'-0" Max.	Top of sign 2" below ceiling
6.	Push-button or control stations	4'-0"	
7.	Top of panelboards or control panels	6'-6"	Maximum (except for

	Component	Height	Comments
			handicapped areas)
8.	Top of telephone back boards	6'-6"	Maximum
9.	Top of local motor controller	6'-0"	Maximum
10.	Top of local disconnect switch	6'-0"	Maximum
11.	Wall mount exterior light fixtures	8'-0"	Unless otherwise shown on Contract Drawings
12.	Wall thermostats	4'-0"	Per Division 23

In situations where there appears to be a conflict with Americans with Disabilities Act (ADA) legislation, utilize the ADA requirements.

1.26 RECEIPTS

A. Some sections of the Specifications call for equipment, materials, accessories, etc. to be provided and "turned over to the Owner" or like requirements. The Contractor shall obtain a receipt for each item turned over, signed by the Owner or its representative. A copy of this receipt shall be transmitted to the Engineer.

B. When a question arises concerning whether items have been turned over to the Owner, and there is no signed receipt, it may be assumed that the items were not provided.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 260000

SECTION 260100 - ELECTRICAL DEMOLITION

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, equipment, materials, and supplies necessary for and reasonably incidental to demolition of work hereinafter specified, indicated on drawings, required or intended for completion of the work.

B. Major items included under demolition work include, but are not limited to:

1. Interior electrical systems in the existing Sodium Hypochlorite Building.
2. Site underground raceway for lighting, power, instrumentation, and security to existing Sodium Hypochlorite Building.

C. Repair those areas damaged under demolition work once new services and systems have been installed.

1.2 SUBMITTALS

A. No submittals are anticipated under this Section.

1.3 JOB CONDITIONS

A. Provide adequate protection to persons and property. Execute work in such a manner as to avoid interference with required operations and use of or passage to and from adjoining buildings and facilities.

B. Demolition work of equipment necessary for the operation of the power and communication systems to be coordinated with the installation of new equipment. The demolition and installation work is to be done as quickly as possible to minimize any burdens on the Owner.

1.4 CONDITION OF EXISTING FACILITIES

A. Contractor shall verify the areas, conditions and features necessary to tie new work into existing construction. This verification shall be done prior to submittal of shop drawings, fabrication or erection, construction or installation. The Contractor shall be responsible for the accurate tie-in of the new work to existing facilities.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 SCHEDULES

A. Schedule all demolition work as to cause minimal interference with existing facility operations. Refer to Specification Divisions 0 and Division 01 for additional requirements.

B. Obtain prior approval of the Owner at least seven days in advance before starting demolition of any equipment. Under no circumstances will demolition work be approved until new equipment is ready for installation.

3.2 PREPARATION

A. Preserve in operating condition all active utilities transversing the project site. Protect all equipment that remains (electrical and mechanical) during demolition, and repair all damage caused by this work to satisfaction of Engineer.

3.3 APPLICATION

A. All existing electrical distribution equipment, lighting fixtures, receptacles, control equipment and switches being removed shall be disposed of by the Contractor. Refer to 260000 for more details.

B. Conduits, wire and wood products that are not salvageable shall be disposed of legally.

C. Primary work shall be completed with all facilities kept in service or with short periods of scheduled momentary outages.

3.4 STORAGE AND HANDLING

A. The Owner reserves the right to save materials that are a part of the demolition work, and the Contractor shall turn over and store any such materials at the Owner's direction.

B. All materials not turned over to Owner shall become property of Contractor and removed promptly from project site at no additional cost to the Owner. Any permits or fees for disposal shall be the responsibility of the Contractor.

3.5 CLEANUP

A. Burn no materials or debris on premises.

B. Remove from site rubbish and debris found thereon and, except as otherwise specified, materials and debris resulting from work of demolition. Leave site in safe and clean condition.

END OF SECTION 260100

SECTION 260519 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. All wire and cable shall conform to the latest requirements of the NEC and shall meet all ASTM/UL specifications. Wire and cable shall be new; shall have size, grade of insulation, voltage rating and manufacturer's name permanently marked on the outer covering at regular intervals. Complete descriptive literature shall be submitted to the Engineer for review and acceptance prior to installation.

B. Building wire #12 - #1 shall be applied based on a 60° C temperature rise. Building wire larger than #1 may be applied at its 75° C temperature rise.

1.2 DELIVERY, STORAGE AND HANDLING

A. Wire and cable shall be suitably protected from weather and damage during storage and handling and shall be in first class condition when installed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Building Wire (types "THWN" and "THW"-cu.) – "Collyer," "Rome," "American," "Carol," or equal.

B. Flexible Cords and Cables (Types "SO" (600V) "SJO" - 300V) "Collyer," "American," "Carol,"or equal.

F. Instrumentation Cables (Shielded) 600V mx. – "Eaton-Dekoron," "Manhatton," "American," "Belden," "Okonite," or equal.

2.2 MATERIALS

A. General

1. In general, all conductors shall be 98 percent conductive, annealed copper unless otherwise noted on the Contract Drawings.
2. Conductors shall be type THWN insulation. Conductor size shall be AWG (American Wire Gauge) Standard. Minimum conductor size shall be AWG number 12 except branch circuits in excess of 75 feet from panel to first outlet not smaller than no. 10 AWG. Minimum voltage rating shall be 600 volts. Conductors for small power may be solid (i.e. lighting, receptacles), but conductors for control work shall be stranded.

3. Conductors with high temperature rated insulations and special construction shall be used where required in connecting to light fixtures or appliances that have special requirements.

B. Instrument Cables

1. Refer to Part 3 of this Specification Section.

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/ERECTION

A. General

1. Conductors shall be continuous from outlet to outlet and no splices shall be made except accessible in junction or outlet boxes. Wire connectors of insulating material or solderless pressure connectors, properly taped, shall be used for all splices in wiring, wherever possible.
2. Conductors shall be color coded in accordance with the following schedule:

	480/277V 3 Phase	120/240, Single Phase
Phase A	Brown	Black
Phase B	Orange	Red
Phase C	Yellow	
Neutral (Grounded)	White or Light Gray	White or Light Gray
3-Way Tracers		Blue
Grounding	Green	Green
Remote Energized Conductors (Control)		Yellow
Control	Per NFPA 79	

3. Conductors shall be pulled into raceways in strict accordance with manufacturer's recommendations.
4. Ample slack conductors shall be allowed at each terminal point, and pull or junction box, to permit installation with ease and without crowding.
5. All conductors terminating at terminal blocks shall be identified with numbers and/or letters identical to circuit or control identification.

6. No conductors shall be drawn into conduits until all work which may cause wire or cable damage is completed. Wire pulling shall be accomplished utilizing machinery and accessories intended for the purpose.
7. All connections and splices shall be made in accordance with conductor manufacturer's recommendations, and as written herein.
8. If the size and number of conductors in a conduit on the Drawings is not shown, then it shall be assumed to be 3 #12, 3/4 inch C.
9. In general, feeder sizes shown are based on no more than three current carrying conductors in a conduit. Multiple small branch circuit feeders may be combined in a common conduit, provided conductors are derated in accordance with NEC article 310.15.
10. Unless otherwise specifically indicated, neutrals may not be shared.

B. Low Voltage Feeders

1. All low voltage feeders shall be 480 volt, 240 volt, or 208 volt as noted in the Contract Drawings. Three phase, 4 wire for power and 208/120 volt, 3 phase, 4 wire for general lighting, unless otherwise noted. The Contractor shall furnish and install all feeders from the distribution center(s) to each of the other structures/subpanels as shown on the Contract Drawings.
2. Wire shall be factory color coded for each phase and neutral, with green used for the ground conductor. As far as practical, all feeders shall be continuous from origin to panel termination without running splices in intermediate pull boxes.

C. Single-Pair Shielded Instrument Cable

1. Tinned copper, XLPE insulated stranded conductors, No.16 AWG minimum, twisted pair with overall shield, stranded tinned No.18 AWG copper drain wire and overall PVC jacket. Rated for 600 volts minimum and conforming to UL 1581.
2. Manufacturers: Provide products of one of the following:
   a. Belden Company.
   b. Okonite Company.
   c. Dekoran Wire and Cable Company.
   d. Or Equal.

D. Multi-Paired Shielded Instrument Cable

1. Tinned copper, XLPE insulated stranded conductors, No.16 AWG minimum, twisted pair with shield over each pair, stranded tinned No.18 AWG copper drain wire and overall PVC outer jacket. Rated for 600 volts minimum and conforming to UL 1581 or UL 13.
2. Manufacturers: Provide products of one of the following:
   a. Belden Company.
   b. Okonite Company.
   c. Dekoran Wire and Cable Company.
   d. Or Equal.

END OF SECTION 260519

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SECTION 260526 - SECONDARY GROUNDING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Grounding shall be done in accordance with the NEC, as described in these Specifications, and as shown on the Contract Documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Grounding equipment shall be Cadweld, Thomas and Betts Blackburn, Connector Castings, Inc., Copperweld Bimetallics Group, Cathodic Engineering Equipment Co., Harger, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/ERECTION

A. Grounding shall utilize a counterpoise and driven ground rod system to achieve the design ground resistance.

B. The ground system shall be continuous with all structures on a common ground. This can be accomplished by bonding all conduits together and bonding to the ground bus at each equipment enclosure. Bonding jumpers shall be required at all pull boxes, and at all motor casings. A separate grounding conductor shall be pulled in all conduits in addition to wire counts shown on Drawings.

C. Ground rods shall be 3/4 inch x 10 foot-0 inch copper clad type. Where multiple rods are driven, they shall be separated by at least 20 feet to assure maximum effect.

D. Ground resistance between ground and absolute earth shall not exceed 5 ohms.

E. All grounding and grounding electrode systems shall be as required by the NEC as for types of electrodes utilized and sizing of grounding conductor to service equipment from the electrode system. These shall include footer rebar, buried metal water pipe, buried bare copper conductor, etc.

F. All concealed grounding electrode system connections shall be made using exothermic welds, Cadweld, Harger, or equal. No splices are allowed in the grounding electrode conductor.

G. An insulated, isolated ground shall be run from building service entrances to panels serving computers as detailed on the drawings.

3.2 FIELD QUALITY CONTROL

A. Testing

1. The Contractor shall be required to provide all labor, tools, instruments, and materials as necessary to perform testing of the grounding electrode system. Results shall be submitted in writing to the Engineer. The testing shall be done to determine the effectiveness of the selected grounding scheme and to see that it conforms to resistance specified (5 ohms maximum).
2. The testing should be done using a fall-of-potential method test at the point of grounding electrode conductor connection to main power distribution equipment and at each separately derived system or MCC. The test shall be performed no sooner than 48 hours after a rainfall event.
3. The written report should contain the following information:

    a. Type of ground scheme used, i.e., building steel, driven rod, mat, etc.
    b. Type of instrument used.

        1) Manufacturer
        2) Model Number
        3) Confirm fall-of-potential test
        4)* Serial Number
        5)* Where instrument was obtained

        * These 2 items are required so that the same instrument may be utilized should reproduction of the test be necessary due to unsatisfactory readings/instrument miscalibration.

    c. Ground resistance readings obtained at various test distances.
    d. Ground resistance/distance curve.
    e. Value of Grounding Electrode Resistance at knee of curve.
    f. Sketch showing setup of instrumentation and location of grounding electrode and test probes.
    g. Proposed method to achieve the specified resistance, should an unacceptable reading be obtained.
    h. Ground resistance readings obtained (if applicable) after modifications incorporated.

3.3 GROUND ENHANCEMENT MATERIAL

A. Where indicated on the Drawings or as deemed necessary by the Contractor to achieve design grounding electrode system resistance, a ground enhancement material shall be utilized, in accordance with manufacturer's recommendations.

B. The ground enhancement material must be permanent and maintenance free (no recharging with salts or chemicals which may be corrosive) and maintain its earth resistance for the life of the system. It must set up firmly and not dissolve or decompose, or otherwise pollute the soil or local water table. The material shall be capable of being applied dry or in a slurry form, and shall reduce resistance by at least 40 percent.

C. Basic components of this material shall be carbon, hydraulic cements, and hydrous aluminum

silicates. Minimum 4-inch diameter holes shall be used with ground rod installations, with depth 6 inch shorter than length of rod, completely filled with the material. Trenches for grounding electrode conductor shall also utilize this material the full length from electrode to building, in accordance with manufacturer installation recommendations, except trench depth shall allow buried conductor to be at least 2'-6 inch deep.

D. Ground enhancement material shall be GEM by Erico Products, Powerfill by Cathodic Engineering Equipment Company, Harger UltraFill, or equal.

END OF SECTION 260526

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SECTION 260529 – SUPPORTING DEVICES AND HANGERS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Provide a system of supporting devices and hangers to ensure secure support or bracing for conduit, electrical equipment, including safety switches, fixtures, panelboards, outlet boxes, junction boxes, cabinets (control panels), etc.

B. All electrical equipment shall be rigidly mounted, and installed using supporting devices as indicated, required by the work, or as described herein.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide appropriate supporting devices and hangers as manufactured by Erico Products, Inc., Steel City, Rayco, or equal:

1. Vertical flange clamps (beam clamps).
2. "Z" purlin clips.
3. Conduit clips.
4. Universal clamps (Beam clamps).
5. Beam clamps (set screw type).
6. Combination push-in conduit clips.
7. Combination conduit hanger clamps.
8. Flexible conduit clips.
9. Special combination conduit clips.
10. One hole steel straps.
11. Minerallac conduit hangers.

B. Strut type channel shall be Unistrut, Kindorf, or equal.

2.2 MATERIALS

A. All mounting brackets and strut used outside shall be aluminum. Fasteners used to mount equipment outside shall be stainless steel. The only exception to the above shall be anchor bolts for area lightpoles which shall be allowed to have galvanized threads and galvanized nuts.

B. All mounting brackets and strut used inside shall be aluminum. Fasteners used inside to mount equipment into concrete shall be stainless steel.

C. Stainless steel (non-magnetic) or fiberglass resin strut shall be used in the Sodium Hypochlorite Building.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Secure conduits to within 3’ of each outlet box, junction box, cabinet, fitting, etc., and at intervals not to exceed ten feet (10’) for EMT conduit and in accordance with Table 344.30 (B) (2) for Rigid Steel conduit.

B. Install clamps secured to structure for feeder and other conduits routed against the structure. Use drop rods and hangers or racks to support conduits run apart from the structure.

C. Furnish and install suitable angle iron, channel iron or steel metal framing with accessories to support or brace electrical equipment including safety switches, fixtures, panelboards, outlet boxes, etc.

D. Fasteners used to mount equipment into concrete shall be stainless steel.

E. All freestanding equipment shall be anchored to its foundation using stainless steel expansion bolts of the type, size, and number recommended by the equipment manufacturer.

F. Paint all supporting metal not otherwise protected, with rust inhibiting primer and then with a finish coat if appropriate to match the surrounding metal surfaces. (Prepainted or galvanized support material is not required to be painted or repainted.)

G. Support all fixtures from the structure as detailed on the drawings to comply with seismic requirements for the specified area.

H. Use of chains, perforated iron, bailing wire, or tie wire for supporting conduit runs will not be permitted.

END OF SECTION 260529

SECTION 260533 - RACEWAYS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This section of the Technical Specifications includes all raceways for accommodation of electrical conductors, communications conductors, sleeves for underground electrical installations, conduit stubs for future installations, fittings and accessories.

B. All raceways shall be marked with the manufacturer's name or trademark as well as type of raceway and size. This marking shall appear at least once every 10 feet and shall be of sufficient durability to withstand the environment involved. All raceways shall be furnished and installed as outlined under Part 3 of this Specification.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Tubular Raceways

1. Steel, Galvanized, Rigid, Heavy-Wall, Threaded – "Wheatland Tube Co.," "Triangle," "Allied Tube & Conduit Corp.," or equal.
2. Steel, Galvanized, Thin-Wall, Electric-Metallic-Tubing (EMT) – "VAW," "Triangle," "Allied Tube & Conduit Corp." or equal.
3. Aluminum, Rigid, Heavy-Wall, Threaded – "VAW," "Alcoa," "Reynolds," or equal.
4. Plastic (PVC); Type A (Thin Wall); Type 40 (or Schedule 40); Type 80 (or Schedule 80) (Heavy -Wall) – "Robin-Tech," "Carlon," or equal.
5. Flexible Metal Conduit – "AFC," "Alflex," or equal.
6. Liquidtight Flexible Metal Conduit – "Carol Cable Co., Inc.," "Superflex," "OZ Gedney," or equal.
7. PVC Coated Rigid Steel – "Robroy", "Korkap" or equal.
8. Factory Coated Aluminum Conduit - Alumax "ALX-1", or equal.
9. Fiberglass Conduit – FRE Composites, United Fiberglass, or equal.

B. Wireways

1. "Square-D," "Hoffman," or equal.

C. Raceway Fittings

1. Conduit fittings – "Crouse-Hinds," "Appleton," "OZ Gedney," or equal.
2. Non-metallic conduit fittings – "Robin-Tech," "Carlon," "Scepter," or equal.
3. PVC coated rigid steel fittings shall be provided by the conduit manufacturer.
4. Flexible conduit fittings – "Raco," "T & B," "OZ Gedney," or equal.

2.2 MATERIALS

A. Aluminum Conduit

1. Aluminum conduit shall be extruded from alloy 6063 and shall be the rigid type, non-toxic, corrosion resistant, and non-staining. It shall be manufactured per UL standards as well as listed/labeled by same.
2. Fittings, boxes, and accessories used in conjunction with aluminum conduit shall be die cast, copper free type. They shall be resistant to both chemical and galvanic corrosion. All covers shall have neoprene gaskets.
3. Aluminum conduit shall not be used in underground applications.

B. Rigid Steel Conduit

1. Rigid steel conduit and fittings shall be of mild steel piping, galvanized inside and out, and shall conform to UL standards. The conduit and fittings hall be listed and labeled by UL as well. The galvanized coating of zinc shall be of uniform thickness applied by the hot-dipped process, and shall be applied also to the threads. It shall be further dipped in a chromic acid bath so as to chemically form a corrosion resistant protective coating of zinc chromate which has a characteristic yellow-green color. Each piece of conduit shall be straight, free from blisters and other defects, cut square and taper reamed. It shall be delivered with plastic protectors on the threads.

C. Polyvinylchloride (PVC) Conduit

1. PVC conduit and fittings shall be Schedule 40, 80 heavy wall, or thinwall, as indicated in these Specifications manufactured to conform to UL standards. It shall be listed and labeled by UL. It shall have at least the same temperature rating as the conductor insulation. Expansion joints shall be used as recommended by the manufacturer in published literature. PVC systems shall be 90 degrees Celsius minimum UL rated, have a tensile strength of 7,000 psi @ 73.4 degrees Fahrenheit, flexural strength of 11,000 psi and compressive strength of 8,000 psi.

D. Electrical Metallic Tubing (EMT)

1. EMT shall be high grade steel with an exterior galvanized coating of zinc applied uniformly by the electro-galvanized process. The interior surface shall be uniformly coated with aluminum lacquer or enamel. After galvanizing, it shall be dipped in a chromic acid bath to chemically form a protective coating of zinc chromate. The conduit shall conform to UL standards and be listed as well as labeled by UL.

E. Flexible Conduit

1. Flexible metallic conduit shall be constructed from flexibly or spirally wound elecro-galvanized steel. Connections shall be by means of galvanized malleable iron squeeze type fittings, or tomic twist-in type in sizes not exceeding 3/4 inch. Liquidtight conduit shall be light gray in color and have sealtight fittings, type UA.

F. PVC coated rigid conduit shall be hot dip galvanized prior to PVC coating. All threads shall be galvanized. The exterior galvanized surface shall be coated with a primer prior to PVC coating to insure adhesion. The bond on conduit and fittings shall be greater than the tensile strength of

the plastic coating. The PVC coating on the exterior of the conduits shall be applied by a plastisol dip method to a nominal thickness of 40 mils, minimum. The interior of the conduit and fittings, and threads shall be painted with a urethane coating. The coating shall allow flexibility for field bending without cracking. PVC sleeves shall be formed at each female opening, with the inside diameter of the sleeve matching the outside of the conduit.

G. Conduit Fittings

1. Rigid Steel Conduit Fittings

a. Standard threaded couplings, locknuts, bushings, and elbows made only of steel or malleable iron are acceptable. Integral retractable type IMC couplings are acceptable also.
b. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
c. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
d. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted or use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
e. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, installed fittings in flush steel boxes with blank coverplates having the same finishes as that of other electrical plates in the room.
f. Fittings for PVC coated rigid conduit shall be manufactured by the maker of the conduit.

2. Rigid Aluminum Conduit Fittings

a. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials. Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
b. Locknuts and bushings: As specified for rigid steel and IMC conduit.
c. Set screw fittings: Not permitted for use with aluminum conduit.

3. Electrical Metallic Tubing Fittings

a. Only material of steel or malleable iron is acceptable.
b. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 2-inches and smaller. Use set screw type couplings with four set screws each for conduit sizes over 2-inches. Use set screws of case hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
c. Indent type connectors or couplings are prohibited.
d. Die-cast or pressure-cast zinc-alloy fittings or fittings made of “pot metal” are prohibited.

4. Expansion and Deflection Couplings

    a. Accommodate 1.9 cm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
    b. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL, and the NEC code tables for ground conductors.
    c. Watertight, seismically qualified, corrosion-resistant, threaded for and compatible with rigid or intermediate metal conduit.
    d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material and stainless steel jacket clamps.

PART 3 - EXECUTION

3.1 PREPARATION

A. Exterior underground metallic conduits shall be degreased, pretreated, and coated with 2 coats of Carboline 888 epoxy, or equal. Other finishes may be acceptable upon the Engineer's review.

3.2 INSTALLATION

A. Conduit

1. All conduit shall be installed in a first class workmanship manner. It shall be installed in horizontal and vertical runs in such a manner as to ensure against trouble from the collection of trapped condensation and shall be arranged so as to be devoid of traps wherever possible. Special care shall be used in assuring that exposed conduit runs are parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. No open wiring is allowed.
2. Fittings or symmetrical bends shall be required wherever right angle turns are made in exposed work. Bends and offsets shall be avoided wherever possible, but where necessary, they shall be made with an approved conduit bending machine. All conduit joints shall be cut square, reamed smooth and drawn up tight, using couplings intended for the purpose.
3. Conduits shall be securely fastened to all sheet metal outlets, junction and pull boxes with double galvanized locknuts and insulating-grounding bushings as required by the NEC. Conduit crossings in insulating roof fill will require both conduits to be secured to the roof deck, and these crossings can only be made where the insulating fill is a minimum of 3 inches deep. Runs of exposed conduit shall be supported in accordance with the NEC using cast aluminum or malleable iron one hole pipe straps with spacers to provide an air space behind the conduit. Stainless steel minerallac, one piece conduit clamps shall be acceptable where located such that building occupants are not in danger of inadvertent contact, since this type fitting has several sharp edges. In general terms, they may be considered in areas such as on or above ceilings, or high on walls. All conduit in walls and slabs shall be securely braced, capped (wooden plugs are prohibited), and fastened to the forms to prevent dislodgement during vibration and pouring of concrete.
4. During construction, all conduit work shall be protected to prevent lodgement of dirt, plaster or trash in conduits, fittings or boxes. Conduits which have been plugged shall be

entirely freed of accumulations or be replaced. All conduits in floors or below grade shall be swabbed free of debris and moisture before wires are pulled. Crushed or deformed conduit shall not be permitted.

5. All open conduit work through new walls or slabs shall be run through sleeves that shall be made watertight. These sleeves shall be PVC of suitable diameter to permit the passage of the conduit used.
6. Where GRS conduit penetrates a floor slab the conduit shall be painted with 2 coats of Koppers Bitumastic 300-M or equal to a point 6 inches above the penetration.
7. The final section of conduit connecting each motor or piece of utilization equipment subject to vibration shall be of the flexible type. Type "UA" shall be used in all process areas and in outdoor or wet locations. Flexible conduit to space heaters shall be long enough to allow swivel action.
8. All underground conduits entering a building shall be sealed against water/condensate entering around the conductors. Sealant may be silicone rubber based caulk.
9. In certain situations, conduit expansion joints shall be required to ensure against conduit and/or cable damage due to settling or thermal expansion and contraction. These expansion joints shall be required where required by the manufacturer or the Contract Drawings and shall be installed per manufacturer's instructions.
10. All conduits to be added to an existing structure shall be exposed in unfinished and process areas.
11. Conduits entering from underground into buildings shall be watertight through the wall, both inside and outside.
12. PVC conduit installed underground for low voltage application shall be schedule 80, and shall be concrete encased. Where PVC conduit is installed, transition shall be made to PVC coated GRS conduit at bends where wire pulling could cut conduit or where routing through concrete.
13. Aluminum conduit shall not be used underground, in chlorine storage/feed areas, or placed in concrete slabs, unless it is UL listed for the purpose and factory pre-coated.
14. Conduit stubs, for future use, extended through outside walls shall be capped with threaded pipe caps and coated to prevent corrosion. Stubs shall extend 5 feet beyond the walls from which they are stubbed unless otherwise indicated on the Contract Drawings.
15. All metal raceway systems shall be grounding conductive solidly bonded throughout and grounded in accordance with NEC requirements and/or as noted on the Contract Drawings. In addition, all raceway systems shall be provided with separate grounding conductors.
16. Minimum conduit size shall be 3/4 inch. The following table shows the minimum burial depth required for all exterior conduit or cable:

Rigid Metal Conduit	24"
Schedule 80 PVC	30"
Schedule 40 PVC, thinwall, of fiberduct, Concrete Encased	18"

17. Wire pulling shall be facilitated by the use of a UL approved pulling compound in pulls over 30 feet in length or where there are 2 or more 90 degree bends. Only polypropylene, nylon, or manila pulling ropes will be permitted. Standard industry recognized wire pulling equipment shall be used.
18. All conduits entering and leaving instrument enclosures shall be sealed around the wires with silicone caulk.
19. Areas of use for each type of conduit:

Buildings – Interior	Schedule 80 PVC	EMT	GRS	Fiberglass	Aluminum	PVC Coated GRS
Process Areas (Exposed)			X	X	X	X
Process Areas (Concealed)	X		X	X	X	X
Non Process Areas (Exposed)			X		X	X
Non Process Areas (Concealed)	X	X	X	X	X	X
Chemical Feed Rooms (Exposed)	X			X		X
Chemical Feed Rooms (Concealed)	X			X		X
Exterior Underground						
Low Voltage	X		X	X		
Exterior Exposed						
Low Voltage						X

20. Underground raceways (conduit) shall be provided with steel sleeves where they pass over or under obstructions, such as: sidewalks; roadways; piping; etc.
21. All conduit shall have an insulated ground wire pulled to all equipment and receptacles.
22. EMT conduit fittings shall be compression type.
23. All raceway runs are shown diagrammatically to outline the general routing of the raceway. The installation shall be made to avoid interference with pipes, ducts, structural members or other equipment. Should structural or other interference prevent the installation of the raceways, or setting of boxes, cabinets, or the electrical equipment, as indicated in the Drawings, deviations must be approved by the Owner and after approval, shall be made without additional charges and shown on the Record Drawings.
24. Fire Stop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material. See Section 078400 for complete fire stop requirements.
25. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
26. No conduit shall be run exposed across roofs without first obtaining permission from the Engineer.
27. Conduit may be run inside concrete slabs as long as the slab is at least 6-inches thick and conduit will have at least 12-inches of cover on both sides.
28. Flexible conduit used in mechanical rooms and process areas shall be liquid tight.

END OF SECTION 260533

SECTION 260534 - BOXES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Outlet and junction boxes shall be furnished and installed where indicated on the Contract Drawings, and\or as required by the work in accordance with the NEC.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Boxes – "Queen," "Wiegmann," "Appleton," "Raco," "Bauers," "Crouse-Hinds," "Hoffman," "Robroy Industries," "Cloud Concrete Products," "Spring City," "Carlon," "Sedco," or equal.

2.2 GENERAL

A. All junction and/or pull boxes for dry (non-corrosive) areas shall be of code gauge sheet metal construction, of the inside dimensions as required by code, with covers.

B. Junction and/or pull boxes for wet or damp locations shall be cast metal, rust and corrosion resistant (NEMA 4X), with at least 5 1/2 full threads for each (bossed) conduit opening, and shall be suitable for flush or surface mounting as required with drilled external, cast mounting extensions (bossed to provide at least 1/8 inch between back of box and mounting surface for drainage). Box covers shall be hinged or cap screw retained as required, of the same material as the box and provided with stainless steel (rustproof) hardware.

C. Junction boxes for out-of-doors use, not mounted in concrete may be sheet metal (NEMA 4X), waterproof, rustproof, rain and sleetproof, with hinged covers and latches and provided means of locking by means of keyed locks, tamper-resistant screws or padlocking as required and with clamping cap-screws top and bottom door edges to provide firm contact with gasketing. All gaskets shall be molded (unbroken) neoprene or butyl rubber.

D. NEMA 4X junction and/or pull boxes may be stainless steel, if called for on the Contract Drawings; or non-metallic or cast aluminum.

C. Underground junction or pull boxes shall be constructed of reinforced concrete cast-in-place or pre-fabricated as detailed on the Contract Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION, APPLICATION, AND ERECTION

A. General

1. Outlets shall be installed in the locations shown on the Contract Drawings. The Contractor shall study the general building plans in relation to the space surrounding each outlet, in order that its work may fit the other work required by these Specifications. When necessary, the Contractor shall relocate outlets so that when fixtures or other fittings are installed, they will be symmetrically located according to room layout and will not interfere with other work or equipment.
2. All supports for outlet boxes shall be furnished and installed by the electrical trades.

B. Concealed Work

1. All outlet boxes shall be standard galvanized steel type at least 1-1/2 inches deep, single or gang type of size to accommodate devices shown. Exceptions shall be noted on the Contract Drawings.
2. Standard deep type outlet boxes (concrete rings with appropriate covers) shall be used in floor slab construction so concealed conduits entering sides of boxes can clear reinforcing rods.
3. Boxes for use in masonry construction shall be 2-1/2 inches deep for 4-inch block and 32 inches deep for 6- and 8-inch block. Through wall boxes are prohibited for outlets opposite each other.

C. Exposed Work

1. Outlet or junction boxes for use with exposed steel conduit shall be cast steel. In dry areas sheet steel with rounded corners, made for the purpose.
2. Outlet or junction boxes for use with exposed aluminum conduit shall be copper free, cast aluminum type.
3. Outlet or junction boxes for use with exposed PVC conduit shall be PVC.

D. Pull Boxes

1. Pull boxes for exterior underground work is shown on the Contract Drawings and are the minimum number required. Others may be added at the Contractor's option, but no extra pay shall be allowed. Interior pull boxes are not shown but shall be used as needed. Pull box types are as follows:

Exterior - Per detail on the Contract Drawings.

Interior - Interior pull boxes in dry areas shall be of code gauge steel of not less than the minimum required by the NEC and shall be provided with hinged covers. In wet areas or pipe galleries, they shall be rated watertight, of stainless steel, cast aluminum, PVC, fiberglass, or equal. Hardware shall be stainless steel.

E. Openings in Electrical Boxes

1. All openings in electrical equipment, enclosures, cabinets, outlet and junction boxes shall be by means of welded bosses, standard knockouts, or shall be sawed, drilled, or punched with tools specially made for the purpose. The use of a cutting torch is prohibited. Unused openings shall be plugged per the NEC.

END OF SECTION 260534

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SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 EQUIPMENT LABELING

A. All starters, feeder units in panelboards, switchboards, disconnects, instruments, etc., shall be marked to indicate the motor, outlet, circuit they control, or variable monitored. Marking is to be done with engraved laminated nameplates and shall bear the designation shown on the Contract Drawings where this information is given. Nameplates shall be fastened to equipment with stainless steel screws, minimum of one each side. In no way shall the installation of mounting screws void the NEMA enclosure rating of the equipment in which they are installed. If there are more than one identical unit, they shall be given consecutive numbers or other descriptions as designated by the Engineer. Nameplate background color shall be white, with black engraved letters, unless otherwise noted.

B. Branch circuits in lighting panels shall be typed on a card suitable for the card frame furnished with the panel. The card shall bear the panel designation listed on the Contract Drawings where this information is given, as well as indicate what each circuit controls.

C. Motor control centers, individual wall mounted starters, panelboards, and disconnect switch shall be labeled with vinyl self-adhesive signs that warn of “High Voltage” (state the specific voltage). Main service entrance conduits to a building, where exposed, shall be labeled with the voltage of the service they carry. Other major equipment such as transformers, transfer switches, generator sets, pump control panels, etc., shall be labeled as such. The type of labels to be used shall have orange as the basic color to conform with OSHA requirements, letters shall be black. The labels shall be of proper size to fit flatly on the surface of the enclosure to make for a neat appearance and not interfere with the operating function of the device it is attached to. These labels shall be as manufactured by the Brady Identification Systems Division, Safety Sign Company, Westline Products Company, or equal.

1.2 CONDUIT LABELS

A. Products and Manufacturers: Provide one of the following:

1. B-915-xxxxx by Brady.
2. Or Equal.

B. Shall be pre-tensioned acrylic/vinyl construction coiled to completely encircle conduit for conduit up through five-inch diameter, or pre-molded to conform to circumference of conduit six-inch diameter and larger.

C. Attach strap-on style for six-inch diameter conduit with stainless steel springs.

D. Shall be blank for use with custom printed labels.

E. Custom Labels:

1. Shall have black lettering on yellow background.

2. Shall not contain abbreviations in legend.
3. Shall be custom printed on continuous tape with permanent adhesive using thermal printer specified below.

1.3 WIRE IDENTIFICATIONS

A. Heat Shrinkable Wire and Cable Labeling System:

1. White heat-shrinkable irradiated polyolefin shrink-on sleeves. Labels shall be thermal printed. Labels shall be at least two inches wide.
2. Products and Manufacturers: Provided one of the following:
    a. B-341 PS-xxx-2W by Brady.
    b. Or Equal.

B. Wrap-Around Wire and Cable Labeling System:

1. Self-laminating white/transparent self extinguishing vinyl strips. Length shall be sufficient to provide at least 2.5 wraps. Labels shall be thermally printed and at least two inches wide.
2. Products and Manufacturers: Provided one of the following:
    a. THT-XX-427 by Brady.
    b. Or Equal.

1.4 DETECTABLE UNDERGROUND WARNING TAPE

A. Material: Polyethylene or polyester with detectable metal core and polyester underlaminate.

B. Width: Two inches.

C. Color and Labeling: Yellow or red with permanently imprinted black letters: "CAUTION – Buried Electric Service" or "Buried High Voltage Cable", repeated continuously over full length of tape.

D. Products and Manufacturers: Provide one of the following:
1. Indentoline by Brady.
2. Or equal.

1.5 THERMAL PRINTING SYSTEM:

A. Utilize thermal transfer process to provide non-smearing labels and markers.

B. Wire and Cable Markers:
1. Portable, Products and Manufacturers: Provide one of the following:
    a. TLS2200 by Brady.
    b. Or equal.
2. Desktop, Products and Manufacturers: Provide one of the following:
    a. 200M by Brady.
    b. Or equal.

C. Cable Markers:
    1. Portable, Products and Manufacturers: Provide one of the following:
        a. Handimark by Brady.
        b. Or equal.
    2. Desktop, Products and Manufacturers: Provide one of the following:
        a. Labelizer PLUS by Brady.
        b. Or equal.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide electrical identification in accordance with manufacturer recommendations and as required for proper identification of equipment and materials.

B. Engraved Identification Devices (Nameplates and Legend Plates):

1. Unless otherwise specified, attach permanent nameplates with permanent adhesive and with 3/16-inch diameter, round head, stainless steel machine screws into drilled and tapped holes.
2. Provide nameplate with 1.5-inch letters to identify each console, cabinet, panel, or enclosure as shown or indicated.
3. Provide nameplates for field-mounted motor starters, disconnect switches, manual starter switches, pushbutton stations, and similar equipment operating components, which shall describe motor or equipment function and circuit number.
4. Provide nameplates with 1/2-inch letters to identify each junction and terminal box shown or indicated.
5. Motor Control Centers:
    a. Provide nameplate with 1.5-inch letters with motor control center designation.
    b. Identify individual door for each unit compartment with nameplate identifying controlled equipment.
6. Except conduit, all electrical appurtenances including lighting panels, convenience outlets, fixtures, and lighting switches, shall be provided with nameplates indicating appropriate circuit breaker number(s).
7. Push Buttons:
    a. Provide legend plates for identification of functions.
    b. Provide nameplates for identification of controlled equipment.
    c. Provide red buttons for stop function.
    d. Provide black buttons for other functions.
8. Pilot Lights:
    a. Provide legend plates for identification of functions.
    b. Provide nameplates for identification of controlled equipment.
    c. Shall have lens colors as shown or indicated. Where no color is indicated, provide the following lens colors:

Color	Legend
Green	Running, Open
Red	Stopped, Closed
Amber	Alarm
Blue	Power
White	Status

9. Selector Switches:
   a. Provide legend plates for identification of functions.
   b. Provide nameplates for identification of controlled equipment.
10. Panel Mounted Instruments:
   a. Provide nameplates for identification of function.
11. Interiors of Cabinets, Consoles, Panels, Terminal Boxes, and Other Enclosures:
   a. Provide nameplates for identification.
   b. Provide each item inside cabinet, console, panel, terminal box, or enclosure with laminated plastic nameplate as shown on approved Shop Drawings and submittals. Install nameplates with adhesive.
   c. Interior items requiring nameplates include:
      1) Terminal blocks and strips.
      2) Bus bars.
      3) Relays.
      4) Rear of face-mounted items.
      5) Rear of door-mounted items.
      6) Interior mounted items that require identification when mounted externally.
   d. Circuit Breaker Directory:
      1) Provide engraved laminated plastic directory listing function and load controlled for each circuit breaker within panel used for power distribution.
12. Re-label existing equipment whose designation have changed.

C. Safety Signs and Voltage Markers:
1. Provide safety signs and voltage markers on and around electrical equipment as shown or indicated.
   a. Install rigid safety signs using stainless steel fasteners.
   b. Clean surfaces before applying pressure-sensitive signs and markers.
2. Install high voltage safety signs on all equipment doors providing access to uninsulated conductors, including terminal devices, greater than 600 volts.
3. Provide cable tray safety signs on both sides of cable trays at maximum intervals of 20 feet. Install signs on side rails of tray as acceptable to ENGINEER.
   a. Label cable trays that contain conductors greater than 600 volts with cable tray safety signs.
   b. Cable trays that contain conductors greater than 208 volts and less than 600 volts shall be labeled with low voltage safety signs.
   c. Cable trays that contain conductors of 120/208 volts shall be labeled with low voltage markers.
   d. Do not label cable trays that contain only instrument signal cables.
   e. Label cable trays that contain intrinsically safe wiring or cables in accordance with NEC Article 504.
4. Install low voltage safety signs on equipment doors that provide access to uninsulated 480-volt conductors, including terminal devices.
5. Install low voltage markers on each terminal box, safety disconnect switch, and panelboard

installed, modified, or relocated as part of the Work and containing 120/208 volt conductors.

D. Voltage System Identification Directories
   1. Provide voltage system identification directories as required by NEC Article 210 and NEC Article 215.
   2. Provide in each electrical room voltage system identification directory mounted on wall or door at each entrance to room.
   3. For panelboards, switchboards, motor control centers, and other branch circuit or feeder distribution equipment that are not located in electrical rooms, provide voltage system identification directory mounted on equipment.
      a. Directories shall be affixed using epoxy glue. Screws or bolts shall not penetrate equipment enclosures.
      b. Directories shall be readily visible and not obscure labels and other markings on equipment.

E. Arc-flash Safety Signs:
   1. Provide arc-flash safety signs as required by NEC Article 110.
   2. Provide signs for switchboards, panelboards, motor control centers, and industrial control panels. Provide signs for control panels that contain 480 volt equipment.

F. Conduit Labels:
   1. Provide conduits with conduit labels unless otherwise shown or indicated.
   2. Do not label flexible conduit.
   3. Do not label exposed single conduit runs of less than 25 feet between local disconnect switches and their associated equipment.
   4. Conduit labels shall indicate the following information:
      a. Contract Number: Alphanumeric, three or four digits, as applicable.
      b. Conduit Number: Alphanumeric as shown on the Drawings, as assigned by CONTRACTOR for unlabeled conduits, and in accordance with approved submittals.
   5. Provide conduit labels at the following locations:
      a. Where each conduit enters and exits walls, ceilings, floors, or slabs.
      b. Where conduit enters or exits boxes, cabinets, consoles, panels, or enclosures, except pull boxes and conduit bodies used for pull boxes.
      c. At maximum intervals of 50 feet along length of conduit.
   6. Orient conduit labels to be readable.

G. Wire and Cable Identification:
   1. Color-coding of insulated conductors shall comply with Section 26 05 19, Low Voltage Electrical Power Conductors and Cables, Section 26 05 13.23, 15KV Cable, and Section 26 05 13.26, 5KV Cable.
   2. Use heat-shrinkable wire labels where wire or cable is terminated. Use wrap-around labels where wire or cable is to be labeled but is not terminated.
   3. Do not provide labels for the following:
      a. Bare (uninsulated) conductors, unless otherwise shown or indicated as labeled.
   4. Provide wire and cable labels for the following:
      a. New, rerouted, or revised wire or cable.
      b. Insulated conductors.
      c. Wire and cable terminations:
         1) Wire labels shall be applied between 1/2-inch and one inch of completed termination

2) Apply cable labels between 1/2-inch and one inch of cable breakout into individual conductors.
a) Label individual conductors in a cable after breakout as specified for wires.

d. Wire or cable exiting cabinets, consoles, panels, terminal boxes, and enclosures.
1) Label wires or cables within two inches of entrance to conduit.

e. Wire or cable in junction boxes and pull boxes
1) Label wires or cables within two inches of entrance to conduit.

f. Wire and cable installed in cable tray.
1) Wire and cable shall have labels at maximum intervals of 20 feet.

g. Wire and cable installed without termination in electrical manholes.
1) Wire and cable shall have wrap-around labels applied within one foot of exiting manhole.

5. Wire and Cable Identification System:
a. Wire and cable labels shall be imprinted with an identifying designator.
1) Wire and cable extending between two devices or items and that does not undergo a change of function shall be identified by a single unique designator as specified below.

b. Field Wiring:
1) Wire or cable designator shall consist of:
a) Three left-most characters shall consist of the Contract number under which wiring or cable was installed.
b) Fourth character from the left shall be an asterisk (*), a plus sign (+) or a hyphen (-). Do not use other punctuation symbols in a wire designator.
c) Remaining characters shall be alphanumeric and make wire designator unique.
d) Numbering shall reflect actual designations used in the Work and shall be documented in record documents.

c. Cabinet, Console, Panel, and Enclosure Wiring, Internal:
1) New Cabinets, Consoles, Panels, and Enclosures:
a) Wire and cable inside cabinets, consoles, panels, and enclosures shall have designators as specified in Section 40 61 13, Process Control System General Provisions.

6. Modified Cabinets, Consoles, Panels, and Enclosures:
a. New or rerouted wire or cable in existing cabinets, consoles, panels, and enclosures shall be labeled as shown on the Drawings or be assigned a ten-character designator equivalent to field wire designator.

H. Terminal Strip Labeling:
1. Label panel side of terminal to match panel wire number.
2. Label field side of terminal to match field wire number. Terminal number shall not include the Contract number.

J. Detectable Underground Warning Tape:
1. Warning Tape shall be placed in trenches with backfill about 12 inches below finished grade on all medium voltage underground conduit runs and others as indicated on the Contract Drawings.

END OF SECTION 260553

SECTION 262213 - SMALL POWER AND MISCELLANEOUS TRANSFORMERS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Transformer locations and size shall be as shown on the Contract Drawings, as specified herein.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. "Square D", "Eaton" or equal.

2.2 FABRICATION

A. General Purpose Dry-Type Transformers

1. Single phase transformers shall be 480 or 600 volt primary and 120/240 volt secondary. Transformers 25 KVA and larger shall have a minimum of 4 (2 above, 2 below) 2 percent full capacity primary taps.
2. Transformers shall be 150 degrees Celsius temperature rise above a 40 degrees Celsius ambient. All insulating materials are to be in accordance with the latest NEMA Standards for a 220 degrees Celsius UL recognized insulation system.
3. Transformer coils shall be of the continuous wire wound construction and shall be impregnated with non-hygroscopic, thermo-setting varnish. The coils shall also have a final wrap of electrical insulating material to prevent mechanical injury to the wire as well as increasing the electrical breakdown strength.
4. All cores shall be constructed of high grade, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be clamped together with steel angles. The completed core and coil shall then be bolted to the base of the enclosure but isolated from the base by means of rubber, vibration absorbing mounts. There shall be no metal-to-metal contact between the core and coil to the enclosure. On transformers 500 KVA and smaller, the vibration isolation system shall be designed to provide a permanent fastening of the core and coil to the enclosure. To further facilitate vibration and noise isolation, the final section of conduit to the transformer shall be flexible.
5. Transformer shall have an epoxy-resin encapsulated core and coil assembly inside a non-ventilated, 316 stainless steel enclosure that meets NEMA 4X requirements.
6. The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed, and finished in the same color as the motor control equipment. For more details see Division 9 of these Specifications.
7. The maximum temperature of the top of the enclosure shall not exceed 50 degrees Celsius rise above a 40 degrees Celsius ambient.
8. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with NEMA and NEC Standards.

9. The transformer shall be marked “DANGER HIGH VOLTAGE” with labels specified in the section on marking, this Division.
10. The transformers shall be manufactured to requirements of applicable standards, especially as they apply to noise level and surface temperatures.

PART 3 - EXECUTION

3.1 INSTALLATION / APPLICATION / ERECTION

A. Transformers shall be rigidly mounted to the structure or the foundation in the case of freestanding units.

B. Transformers shall be megger tested prior to energization.

C. Transformers with taps shall be adjusted to supply the nominal service voltage required on the secondary.

D. Transformers shall be installed in accordance with NEC requirements and manufacturer recommendations.

END OF SECTION 262213

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This section of the Technical Specifications includes furnishing all labor, materials, equipment, and incidentals required for the installation of all lighting and distribution panelboards as hereinafter specified and as shown on the Contract Drawings.

B. The panelboards for installation under this Contract shall be selected from the following types with the panel voltage and main sizes the determining factors. All panelboards shall be by the same manufacturer.

C. Circuit breakers of size and type shown on Contract Drawings and described herein shall be provided with the panelboards.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. “Square D”, “General Electric”, “Eaton” or equal.

2.2 EQUIPMENT

A. Rating

1. Panelboard ratings shall be as shown on the Contract Drawings. All panelboards shall be rated for the intended voltage.

B. Standards

1. Panelboards shall be in accordance with the Underwriter Laboratories, Inc. “Standard for Panelboards” and “Standard for Cabinets and Boxes” and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code.

C. Panelboard Construction (NEMA 4X FRP)

1. Interiors

a. All interiors shall be completely factory assembled with circuit breakers, wire connectors, etc. All wire connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper or aluminum wire of the sizes indicated.

b. Interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping.
c. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.
d. A nameplate shall be provided listing panel type, number of circuit breakers and ratings.

2. Bussing

a. Bus-bars for the mains shall be of copper. Full size neutral bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Bussing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase bussing shall be full height without reduction. Cross connectors shall be copper.
b. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection. Neutrals shall be rated 200 percent for panelboards supplying non-linear loads (fed from K rated transformers).
c. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.
d. Separate neutral and ground bus shall be provided, insulated and isolated from each other. For isolated ground application, provide another insulated and isolated ground bus.

3. Boxes

a. Surface mounted boxes shall be painted to match the trim. Boxes shall be of sufficient size to provide a minimum gutter space of 4 inches on all sides.
b. Surface mounted boxes shall have an internal and external finish as hereinafter specified. Surface mounted boxes shall be field punched for conduit entrances.
c. At least 4 interior mounting studs shall be provided.

4. Trims

a. Hinged doors covering all circuit-breaker handles shall be included in all panel trims.
b. Doors shall have semi flush type cylinder lock and catch, except that doors over 43 inches in height shall have a vault handle and 3-point catch complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Two keys shall be supplied for each lock. All locks shall be keyed alike; directory frame and card having a transparent cover shall be furnished on each door.
c. The trims shall be FRP.
d. All interior steel surfaces of the panelboard shall be properly cleaned and finished with manufacturer’s standard gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere without cracking or peeling.
e. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

D. Overcurrent Protective Devices (Circuit Breakers)

1. Panelboards shall be equipped with circuit breakers with frame size and trip settings as shown on the Contract Drawings.
2. Circuit-breakers shall be molded case, bolt-in, thermal-magnetic trip.
3. Circuit-breakers used in 120/240-volt panelboards shall have an interrupting capacity of not less than 10,000 amperes, RMS symmetrical, unless otherwise shown in the panelboard schedule or Contract Drawings.
4. Circuit-breakers used in 480-volt panelboards shall have an interrupting capacity of not less than 14,000 amperes, RMS symmetrical, unless otherwise shown in the panelboard schedule or Contract Drawings.
5. GFCI (ground fault circuit interrupter) shall be provided for circuits where indicated on the Contract Drawings. GFCI units shall be 1-pole, 120 volt, molded case, bolt-on circuit breakers, incorporating a solid-state ground fault interrupter circuit insulated and isolated from the circuit-breaker mechanism. The unit shall be UL listed Class A Group I device (5 milliamp sensitivity, 25 millisecond trip time), and an interrupting capacity of 10,000 amperes RMS.
6. Trip elements of multi-pole breakers shall be effectively insulated from one another. Multi-pole breakers shall be designed so that an overload on any pole shall open all poles simultaneously.
7. The breaker operating mechanism shall be the quick-make, quick-break type and shall be entirely trip free to prevent the contacts being held in a closed position against a short circuit.
8. Breakers shall have a thermal bimetallic element for time delayed overload protection and a magnetic element for short circuit protection.
9. The breaker shall be trip indicating with the trip position midway between the “On” and “Off” positions.
10. Breakers for power distribution panels shall be F frame or larger. All breakers rated above 225 amps shall have interchangeable magnetic trip elements.
11. All breakers shall be UL listed, and conform to requirements of NEMA Standards.
12. Breakers for HVAC equipment shall be HACR rated.
13. Breakers as called out in panel schedules shall be arc fault circuit interrupting type.

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/ERECTION

A. Boxes for surface mounted panelboards shall be mounted so there is at least 1/2-inch air space between the box and the mounting surface.

B. Circuit directories shall be typed giving location and nature of load served.

C. Each panelboard shall be nameplated with plastic engraved nameplates stating the panel’s name, voltage, and the name of panel serving the panel. Nameplates shall be secured by use of stainless steel screws.

END OF SECTION 262416

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SECTION 262700 - WIRE CONNECTIONS AND CONNECTING DEVICES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Wire connection and connecting devices shall be as herein specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Connectors, Lugs, etc. - T & B, Anderson, Burndy, or equal.

B. Ties and Servings - T & B, Panduit, or equal.

2.2 MATERIALS

A. Wire Splicing and Terminations (600 Volts and Below)

1. Electrical Terminal and Splice Connectors (#22 - #4 AWG)

a. Terminals and splice connectors from #22 - #4 AWG shall be compression types with barrels to provide maximum conductor contact and tensile strength. Performance, construction, and materials shall be in conformance with UL standards for wire connectors and rated for 600 volts and 105 degrees Celsius.

b. Connectors shall be manufactured from high conductivity copper and entirely tin plated. Terminal barrels shall be serrated on the inside surface and have a chamfered conductor entry. Terminals shall have funnel entry construction to prevent strand fold-back. All barrels shall be brazed seam or seamless construction.

c. Spade type terminals shall be sized for the appropriate stud and shall be locking type that snap firmly onto studs with a close fit for maximum retention. Spade type terminals shall be insulated with an insulation suitable for maintaining a high dielectric strength when crimped and be made form nylon, PVC, or equal.

2. Electrical Lugs and Connectors (#6 AWG - 1000 Kcmil)

a. Lugs and splice connectors from #6 AWG - 1000 Kcmil shall be compression types with barrels to provide maximum conductor contact and tensile strength. They shall be manufactured from high conductivity copper and entirely tin plated. They shall be crimped with standard industry tooling. The lugs and connectors must have a current carrying capacity equal to the conductors for which they are rated and must also meet all UL requirements. All lugs above 4/0 AWG shall be 2 hole lugs with NEMA spacing. The lugs shall be rated for operation through 35

KV. The lugs shall be of closed end construction to exclude moisture migration into the cable conductor.

3. Twist-on Wire Connectors (#22 AWG - #10 AWG)

   a. All twist-on wire connectors must have a corrosion resistant spring that is free to expand within a steel jacket. The steel jacket must be insulated with a flexible vinyl jacket capable of withstanding 105 degrees Celsius ambient temperatures and of sufficient length to cover wires that are inadvertently overstripped.
   b. Each connector size must be listed by UL for the intended purpose and color coded to assure that the proper size is used on the wire combinations to be spliced. The connectors must be compatible with all common rubber and thermoplastic wire insulations.

4. Solderless/re-usable lugs shall be used only when furnished with equipment such as control panels, furnished by others, where specification of compression type lugs is beyond the Contractor's control. In the event their use is necessary, the Contractor shall be responsible for assuring that they are manufactured to NEMA standards, with proper number and spacing of holes and set screws.

PART 3 - EXECUTION

3.1 INSTALLATION, APPLICATION, & ERECTION

A. Insulation of Splices and Connections

1. Connections/splices with a smooth even contour shall be insulated with a conformable 7 mil thick vinyl plastic insulating tape which can be applied under all weather conditions and is designed to perform in a continuous temperature environment up to 105 degrees Celsius. The tape shall have excellent resistance to abrasion, moisture, alkalies, acids, corrosion, and varying weather conditions (including sunlight). The tape shall be equal to Scotch 33+ and shall be applied in conformance with manufacturer's recommendations. In addition, it shall be applied in successive half-lapped layers with sufficient tension to reduce its width to 5/8 of its original width. The last inch of the wrap shall not be stretched.
2. Connections/splices with irregular shapes or sharp edges protruding shall be first wrapped with 30 mil rubber tape to smooth the contour of the joint before being insulated with 33+ insulating tape specified in the previous paragraph. The rubber tape shall be high voltage (69 KV) corona-resistant based on self-fusing ethylene propylene rubber and be capable of operation at 130 degrees Celsius under emergency conditions. The tape must be capable of being applied in either the stretched or unstretched condition without any loss in either physical or electrical properties. The tape must not split, crack, slip, or flag when exposed to various environments. The tape must be compatible with all synthetic cable insulations. The tape must have a dissipation factor of less than 5 percent at 130 degrees Celsius, be non-vulcanizing, and have a shelf life of at least 5 years. The rubber tape shall be applied in successive, half-lapped wound layers and shall be highly elongated to eliminate voids. Other manufacturer's recommendations on installation shall be adhered to. The rubber tape shall be equal to Scotch 23 or 130C electrical splicing tape.

3. Splices made in wet or damp locations shall be made submersible and watertight with special kits made for the application and compatible with type of cables employed.

B. Connection Make-up

1. Connections of lugs to bus bars, etc., shall be made up with corrosion resistant steel bolts having non-magnetic properties with matching nuts, and shall utilize a Belleville spring washer (stainless steel) to maintain connection integrity. Connections shall be torqued to the proper limits. Prior to bolting up the connection, electrical joint compound shall be brushed on the contact faces of the electrical joint.
2. All motor lead connections shall be made up to match the type of lead furnished on the motor. If the lead is not lugged, then twist-on wire connectors may be used. To prevent possible vibration problems, twist-on connectors shall be taped after installation.
3. All lugged motor lead connections (excluding motors over 200 horsepower) shall be made up using ring tongue compression lugs with proper size stainless steel nuts and bolts. Belleville type spring shall be used to maintain tension on the connections. The connections shall then be insulated using the procedure described for irregular shapes, utilizing rubber tape in conjunction with vinyl electrical tape.
4. At the time of final inspection, the Engineer may request the Contractor to disassemble 3 randomly selected motor lead connections in the Engineer's presence, to assure conformance with these Specifications.
5. The Contractor shall include all necessary tools, materials, and labor in its bid for disassembly of the connections and for remaking them with new insulating materials after inspection.

END OF SECTION 262700

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SECTION 262716 – CONTROLS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Equipment control panels and enclosures shall be as specified herein and shown on the Contract Drawings. Legends for starter nameplates shall be taken from the one line diagram in the Contract Drawings.

B. Prior to the delivery and installation of the project control panels (all control panels required as part of the project) at the job site, but after the procurement, assembly, and configuration of all components, the Contractor shall conduct a factory test. This test shall be witnessed by representatives of the Owner and the Engineer. The factory test shall demonstrate the functionality and performance of specified features of the control panels. A complete system checklist shall be available during the test for recording point test results. The Contractor shall schedule the factory test and shall provide the Owner and Engineer with written notice of the start and expected duration of the factory test at least 14 days prior to the start of the test. The Contractor shall record the results of all factory testing on preapproved test forms which the Owner's and Engineer's representatives shall sign. A copy of the completed test forms and a report certifying the results shall be provided to the Engineer within 10 days of completing the test.

1.2 CUSTOM CONTROL PANELS

A. General

1. All control panels furnished under this Contract shall be manufactured in accordance with industry standards and as herein specified. Some control panels are specified to be furnished with the equipment controlled and others are to be furnished by the Contractor, as written elsewhere.
2. Control panels shall be as manufactured by Adgo, Inc., Control Works, Inc., or other panel vendor. Panel construction shall comply with OSHA and other code requirements as applicable, and may be attested to by UL listing the panels as an assembly. Otherwise, panel modifications as required by the Electrical Inspector shall be performed by the supplier at no extra cost to the Owner.
3. Control panels to be furnished on this project shall be wired to function according to schematics shown on the contract Drawings. In addition to the requirements shown on the Contract Drawings, the panels shall adhere to additional requirements as written herein, and in the utilization equipment specifications. All motor starters shall be U.S. NEMA sized, field rebuildable. IEC duty rated devices are unacceptable.
4. Enclosures shall be dead front with all operators' devices accessible without opening the enclosure door. All relays, timers, terminal strips, etc., shall be mounted to a subpanel inside the enclosure. All wiring must be stranded and sized to be protected by a 20A/1P circuit breaker. Supplemental overcurrent protection may be used in lieu of oversized wiring. All panels mounted outside shall have operators devices mounted on an inner door with an outdoor door that is blank.
5. All terminal strips and lugs shall be of a type UL listed to terminate the size and quantity

of wires encountered. Where conduits enter the boxes, if they are NEMA 4 or 3R, sealing locknuts or hubs must be used to maintain the box rating.

6. Certain equipment starters contain non-resettable elapsed time meters as shown in the Contract Drawings. Also, certain motor starters have remote control devices and require connections to operate these control devices as shown on starter schematics (control circuits).
7. All starters contain green "on" lights and red "off" lights, control transformers, and auxiliary contacts to operate as defined on the control circuits of the Contract Drawings. Reset pushbuttons shall also be provided for overloads built into the starters.
8. Enclosures shall be provided with a locking hasp or latch handle with provision for padlocking and any exterior hardware shall be stainless steel or other corrosion resistant material. Enclosures for interior use in dry areas shall be NEMA 4X enclosed, unless otherwise indicated.
9. Elementary control schematics and connection diagrams showing the spatial relationship of components and wiring shall be submitted for review. Also, a bill of materials, drawing of device arrangement on front, and enclosure fabrication drawings shall be submitted. Further, descriptive literature is required on all components. A copy of the shop drawings shall be furnished and stored in a pocket inside the enclosure.
10. Provide metal data pocket, with white enamel finish, on interior of door.
11. Sleeve type wire markers or other "permanent" type marker shall be installed on all wires, keynoted back to the elementary schematic or the connection diagram, and all terminals identified.
12. Environmental Suitability: Indoor and outdoor control panels and enclosures shall be suitable for operation in the ambient conditions associated with the locations designated in the Contract Documents. Heating, cooling, and dehumidifying devices shall be provided in order to maintain all devices within the minimums and maximums of their rated environmental operating ranges. The Contractor shall provide all power wiring for these devices. Enclosures suitable for the environment shall be provided. Enclosures in hazardous areas shall be suitable for use in the particular hazardous or classified location in which it is to be installed.
13. The control panel controls shall be 120 VAC. Where the electrical power supply to the control panel is 240 VAC single-phase, the control panel shall be provided with a control panel transformer. Control conductors shall be provided in accordance with the indicated requirements.
14. Control panels shall be wall-mounted, as indicated. Internal control components shall be mounted on an internal back-panel or side-panel as required.
15. Adequately support and restrain all devices and components mounted on or within the panel to prevent any movement.
16. Provide subpanels for installation of all internally mounted components. All wall-mounted enclosures shall include full height rear subpanels.
17. Wall mounted panels shall be so sized as to adequately dissipate heat generated by equipment mounted in or on the panel.
18. Panels mounted outside or in unshaded areas shall be provided with thermostatically controlled heaters that maintain inside temperature above 40 degrees F.
19. Provide a hand switch controlled fluorescent light and a breaker protected 120 volt, 20 amp GFI type duplex receptacle within each wall mounted panel larger than 4 cubic feet volume.
20. Provide enclosure mounting supports as required for wall mounting enclosures.

21 Provide sun shields for outdoor panels, where indicated on drawings.

a. Sun shields shall be fabricated from minimum 10 gauge aluminum, and shall be designed, fabricated, installed, and supported to fully cover and shade the top, sides, and back of the enclosure, from direct exposure to sunlight.
b. Sun shields shall not be attached directly to the enclosure by drilling holes through, or welding studs to, the enclosure surfaces, and shall be designed and mounted to provide a minimum 1-inch air gap all around the enclosure for air circulation and heat dissipation.
c. The top section of all sun shields shall be sloped at a minimum angle of 5 degrees from the horizontal. For wall-mounted enclosures, the top section shall slope downward away from the wall and towards the front of the enclosure. For freestanding, floor-mounted enclosures the top section shall slope downward towards the backside of the enclosure.
d. The front edge of the top section of all sun shields shall incorporate a narrow and more steeply sloped drip shield segment which sheds water away from the front of the enclosure and prevents it from dripping and/or running directly onto the front panel of the enclosure.
e. All seam welds used in the sun shield fabrication shall be continuous and shall be ground smooth.
f. All exposed corners, edges and projections shall be smooth rounded or chamfered to prevent injury.
g. Contractor shall submit detailed sun shield fabrication and support drawings with the enclosure shop drawings for review and approval.

B. Construction Features

1. Control panel enclosure sizing shall be by supplier in accordance with appropriate standards and codes.
2. Panels and enclosures shall meet the NEMA requirements for the type specified and/or as shown on the drawings.
3. Provide lifting eye bolts to facilitate handling of the enclosures, where required.
4. External welds shall be made by using the Heliarc welding method, whereas internal welds will be made by the wire welding method. All welds shall be neatly formed and free of cracks, blow holes and other irregularities.
5. All inside and outside edges of the panel shall be free of burrs.
6. The panel door or doors shall be a minimum of 80 percent of the front surface area and shall be hinged on the left side when facing the cabinet (right and left outside edges for double door enclosures).
7. Main feeder disconnects shall have a door-mounted handle unless otherwise indicated.

C. Control Panels Located in Wet, Damp, or Corrosive Areas (NEMA 4X FRP)

1. The enclosure(s) will meet or exceed the requirements of a NEMA 4X rating and shall be UL listed.
2. Panels shall be FRP (fiberglass reinforced plastic) construction.
3. Panels shall be provided with heavy duty 3-point latching mechanism with 316L stainless steel key-locking handle. Latch rods shall be provided with rollers for ease of use.
4. Panels smaller than 24 inches H x 20 inches W x 6 inches D shall be provided with fast-operating stainless steel door clamps and hasp and staple for padlocking.
5. Panels shall be provided with continuous heavy duty stainless steel hinge with stainless steel hinge pin(s). The hinge pin shall be capped top and bottom by weld to render it tamper proof.

6. Panels shall be provided with oil-resistant gasket attached with oil-resistant adhesive and shall form a weathertight seal between the cabinet and door.
7. All external hardware shall be 316L stainless steel.
8. FRP enclosures shall be provided with molded-in drip shields to prevent infiltration of liquid or contaminants.
9. Door restraints shall be provided on all exterior panels to prevent door movements in windy conditions.
10. All bolt holes shall be gasketed.
11. Light and/or alarm brackets shall be provided where indicated.
12. Switch Compartment (required where indicated)

    a. A switch compartment, with removable back panel, is to be supplied on the enclosure main door. It shall be large enough to include all operating devices.
    b. The switch compartment door opening shall be double flanged on all four sides for strength and to prevent liquids or dirt from dropping into the compartment when the door is open.
    c. The door shall be furnished with a gasket that satisfies the physical properties as found in UL508 Table 21.1 and will form a weathertight seal between cabinet and door.
    d. The switch compartment door shall have a tight key lock. Five keys shall be furnished with each lock.
    e. The switch compartment door hinge shall be continuous stainless steel with a stainless steel hinge pin.

D. Equipment Mounting

1. Adjustable Channels

    a. The enclosure shall be equipped with two adjustable "C" mounting channels on both side walls and back wall of the enclosure, allowing versatile positioning of shelves or panels.
    b. The mounting channels shall provide infinite vertical and horizontal adjustment and not limit the positioning of shelves or panels. All mounting hardware will be furnished.

2. Shelves

    a. If equipment is to be shelf mounted, the enclosure shall be provided with shelves fabricated from 5052-H32 aluminum having a thickness of 0.125 inch.
    b. The shelf depth shall be a minimum of 10.5 inches. The enclosure will have provision for positioning shelves or panels to within 4 inches of the bottom and to within 8 inches of the top of the enclosure.

3. Aluminum Back Panel

    a. If the equipment is to be panel mounted, the enclosure shall be provided with a 5052-H32 aluminum back panel having a thickness of 0.125 inch.
    b. The panel shall be natural finish. All mounting hardware will be furnished.

4. Print Storage Pocket

a. A control panel shop drawing storage pocket shall be provided inside the enclosure at a convenient location.

E. Cabinet Mounting

1. Wall Mounted Enclosure

a. Enclosures intended for wall mounting shall be provided with stiffener plates with a thickness of 0.125 inch aluminum welded to top and bottom of rear wall for added strength and rigidity.
b. All mounting holes must be gasketed.

F. Thermal Management

1. Indoor Panels

a. The following panel accessories shall be provided where shown on Contract Drawings or where required to maintain an interior panel environment suitable for interior panel mounted components. Panel manufacturer shall size required temperature control equipment per their panel design.

1) Provide thermostatically controlled heaters of sufficient size to maintain temperature inside each enclosure to prevent interior condensation. Heaters shall be fan-driven, with all components mounted in an anodized aluminum housing for sub panel mounting. The heaters shall be powered from 115VAC from a dedicated circuit breaker. Heater shall be Hoffman DAH series, or equal.
2) Provide cooling fans with exhaust grille and filter kits of sufficient size to maintain temperature within enclosure below maximum operating temperature rating of sensitive panel mounted components. Units shall be powered from 115VAC from a dedicated circuit breaker. Cooling fans shall be Hoffman series SF, or equal.

b. Provide internal corrosion inhibitor devices, Hoffman HCI series or equal, for corrosion control inside each enclosure.

2. Outdoor Panels

a. The following panel accessories shall be provided where shown on Contract Drawings or where required to maintain an interior panel environment suitable for interior panel mounted components. Panel manufacturer shall size required temperature control equipment per their panel design.

1) Provide thermostatically controlled heaters of sufficient size to maintain temperature inside each enclosure to prevent interior condensation. Heaters shall be fan-driven, with all components mounted in an anodized aluminum housing for sub panel mounting. The heaters shall be powered from 115VAC from a dedicated circuit breaker. Heater shall be Hoffman DAH series, or equal.
2) Provide thermostatically controlled closed loop heat exchangers or air conditioners with filtered inlets of sufficient size to maintain temperature within enclosure below maximum operating temperature rating of sensitive

panel mounted components. NEMA rating of panel shall be maintained. Units shall be powered from 115VAC from a dedicated circuit breaker. Heat exchangers and air conditioners shall be Hoffman XR and CR series respectively, or equal.

b. Provide internal corrosion inhibitor devices, Hoffman HCI series or equal, for corrosion control inside each enclosure.

G. Surge Suppression

1. A surge protection device shall be installed on the power supply feed to each panel. The power surge protector shall be rated for 120VAC.
2. The power surge protection devices shall have the following performance characteristics:
   a. Maximum Continuous Operating Voltage (MCOV): 150VAC
   b. Maximum Discharge Current (8x20µs, Imax): 40kA
   c. Nominal Discharge Current (8x20µs, In): 20kA
   d. Protection Level (Up): 0.9KV
   e. UL1449 Voltage Protection Rating (VPR): 700V
3. The power surge protection device shall provide (2) form C contacts for remote status indication.
4. The power surge protection device shall be Allen Bradley 4983 series or equal.

H. Power Supplies

1. Power supplies shall be provided for all DC powered panel components. Power supplies shall be single output, regulated, plug-in type, 12 or 24V as required. Power supply shall be rated at 120VAC. Power supply shall be Allen Bradley 1606 sereis, or equal.

I. Acceptable Manufacturers

1. Enclosures shall be as manufactured by Hoffman Enclosures, Inc., or a UL listed equivalent.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 262716

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Wiring devices shall be installed where indicated on the Contract Drawings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. “Hubbell,” “Bryant,” “Cooper,” “Wiremold,” “P&S,” “Leviton,” “Taymac,” “Intermatic,” or equal.

2.2 EQUIPMENT

A. Receptacles

1. Twin-convenience - outlet (exterior) – “Hubbell” cat. no. 5362 with Taymac Corporation or Intermatic, Inc. safety outlet enclosure.
2. Ground fault interrupting receptacles shall be required where shown on the Contract Drawings, and shall be indicated by the abbreviation “GFI” beside the circuit symbol on the Contract Drawings. They shall be rated 20 amps (125 volts) and shall be of the duplex, feed through type, capable of protecting all downstream receptacles on the same circuit. They shall be UL listed and interrupt the current between 4-6 milliamps of ground fault leakage. Appropriate plates shall be furnished and installed. The 20 ampere rating shall apply not only to device internals but to the faceplate as well. Receptacle shall be “Hubbell”, Cat. GF20LA or equal. The hospital grade equivalent cat. no. is GF 8300.
3. Weather-resistant type receptacles shall be required in all outdoor, damp, and wet locations or where shown on Contract Drawings. Receptacle type shall be indicated by the abbreviation “WP” beside the circuit symbol on the Contract Drawings. Receptacle shall be UL Listed. Weather-resistant receptacles shall be “Hubbell” Cat 5362WR or equal. Weather-resistant ground fault interrupting type receptacles shall be “Hubbell” Cat. GFTR20 or equal.

B. Plates and Covers

1. Furnish and install plates of the appropriate type and size for all wiring and control devices, signal and telephone outlets.
2. All device plates shall be nylon (ivory). All device plate screws shall be nylon with countersunk heads. Plates shall be installed vertically and with an alignment tolerance of 1/16 inch. Device plates shall be of the one-piece type, of suitable shape for the devices to be covered. Plates shall have a smooth finish with no crevices to collect dirt. Oversize plates are not acceptable.

3. Covers for boxes serving equipment where flexible conduit is to be tapped into cover plates shall be sheet metal drilled for conduit. Gaskets shall be required as well as all special adapters for mounting.
4. Weatherproof plates shall be Hubbell 5205/5206/CWP26H/CWP8H/WP26 as appropriate for the box utilized, vertical or horizontal mounting.

C. Wall Switches (Tumbler Type)

1. Single pole (exterior) – "Hubbell" cat. no. 1222-gray, or equal, and Bryant 7420 or equal plate.

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/ERECTION

A. Wall Switches

1. Wall switches shall be mounted at a height as indicated in Section 260000, unless otherwise noted on the Contract Drawings.

B. Receptacles

1. Outlets shall be located as shown on the Contract Drawings. Where located in special interior finishes, they shall be properly centered. Boxes shall be of the type noted and accepted for the specific installation.
2. Furnish and install receptacle circuits where called for on the Contract Drawings and/or by these Specifications. Circuits shall be installed in conduit from panel to receptacle, with flush mounted boxes except as noted on the Contract Drawings.
3. Receptacles and lighting circuits shall not be combined on the same overcurrent device. For runs over 75 feet or for 30 amp receptacles, minimum wire size shall be AWG No. 10.
4. Receptacles for specific devices (i.e., clothes dryer), shall be rated at the correct voltage and amperage for that unit.
5. The minimum free length of conductor at each box for the connection of a fixture, switch or receptacle shall be 8 inches. All connections shall be made mechanically and electrically secure.
6. Receptacles shall be duplex type, rated at 20 amps, 125 volts, gray colored, unless otherwise noted. Mounting height shall be as specified for low outlets in Section 260000, except in pipe galleries and pump rooms subject to floods, where they shall be medium height. All receptacles shall be of the grounding type.
8. Duplex receptacles that are located in wet locations shall be weatherproof while in use. This requirement shall apply as indicated on the Drawings. To meet this requirement, appropriate safety outlet covers as manufactured by Taymac Corporation, Intermatic Guardian Series, or equal shall be utilized in these areas.

END OF SECTION 262726

SECTION 262816 – SAFETY SWITCHES

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Provide horsepower-rated, quick-make, quick-break, safety switches provided with the number of poles and fuses as required.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/EQUIPMENT

A. Safety switches shall be as manufactured by General Electric, Square D Company, Eaton, or equal.

B. For 208- and 240-volt circuits, use general-duty type switches with Class R fuse clips. For 480-volt circuits, use heavy-duty type switches with Class R fuse clips.

C. Switches shall have arc shields, shall be of enclosed construction and fusible or non-fusible as indicated. Switches shall be rated for either 250-volt AC or 600-volt AC service as required.

D. Safety switches for all part-winding or two-speed motors requiring remote disconnect to be similar to Square D Series HLL-660, six-pole.

E. All switches shall be capable of interrupting locked rotor current of motor which it serves.

F. Enclosures shall be NEMA-1 for interior use and NEMA-4X for exterior use unless noted otherwise.

G. Provide dual-element Bussman type FRN (250 volt) or type FRS (600 volt) fuses for any fusible safety switch serving a motor circuit.

H. For non-motor loads, provide dual element Bussman type LPN (250 volt) or type LPS (600 volt).

I. All switches shall be capable of being padlocked in either the “On” or “Off” position.

J. Safety switches shall be provided with auxiliary contacts where indicated on Contract Drawings.

K. Safety switches shall be UL listed and shall conform to NEMA Standards. NEMA 4X enclosed safety switches where called for shall be stainless steel, or fiberglass.

L. NEMA 1 enclosed switches shall be phosphate coated as equivalent, code gauge steel with baked enamel finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide non-fusible switches at remote motor locations (raintight where required) as indicated on drawings.

B. Provide fusible disconnects at package A/C units, fused as specified on unit nameplate.

C. Mount switches to walls or to equipment enclosures with a minimum of 4 bolts using toggle anchors for masonry construction, Phillips “Red Head” anchors for poured concrete construction and bolts, jumbo washers, lock washers and nuts for equipment enclosure mounting.

D. All safety switches to be identified with nameplates per Section 260553.

END OF SECTION 262816

SECTION 264113 - LIGHTNING PROTECTION SYSTEMS (AIR TERMINALS)

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The lightning protection system shall be furnished, installed, and connected as detailed on the Contract Drawings to provide a complete and functional system. Installation and equipment construction shall comply with UL Master Label Code 96A, and NFPA 780.

B. The Contractor shall provide shop drawings indicating location and installation of equipment for review of the Engineer before beginning installation.

C. All equipment shall be of the same manufacturer, insofar as possible.

D. Equipment specified herein supplements actual suppression devices specified in Section 264313.

E. Details provided in the drawings shall supersede this general specification in case of conflict.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. "AC Erico", "Thompson Lightning Protection, Inc.," "Harger Lightning & Grounding, Inc.," "Independent Protection Co., Inc.," or equal.

2.2 EQUIPMENT

A. All equipment used in this installation shall be UL approved and labeled in accordance with UL procedures.

B. All equipment shall be new, and of design and construction to suit the application where it is used in accordance with accepted industry standards and NFPA and UL code requirements and as per manufacturers recommendations.

C. Unless otherwise shown, downlead conductors from roof to ground shall be Class I copper of 29 strands, 17 gauge minimum. All main roof conductors shall be Class I aluminum of 24 strands, 14 gauge minimum.

D. Unless otherwise shown, air terminals shall be Class I solid, round aluminum rod of 1/2 inch minimum diameter, and shall project 10 inch minimum above the object to be protected.

E. Air terminal bases shall be of cast aluminum with bolted pressure cable connections and shall be securely mounted with stainless steel screws or bolts. Bases on built-up tar and gravel roofs shall be secured with a proper adhesive and shall have a minimum surface contact area of 18.5

square inches.

F. Ground rods shall be a minimum of 3/4 inch in diameter and 10 feet long. They shall be connected to the system using exothermic welds, Cadweld, Harger, or equal.

G. Cable fasteners shall be substantial in construction, electrolytically compatible with the conductor and mounting surface and shall be spaced according to NFPA and UL code requirements.

H. Bonding devices, cable splicers and miscellaneous connectors shall be of cast aluminum with bolted pressure connections to cable. Cast or stamped crip fittings are not acceptable.

I. Equipment on stacks and chimneys shall be protected from corrosion and sized in accordance with NFPA and UL requirements.

J. All miscellaneous bolts, nuts, and screws shall be stainless steel.

K. An approved bimetal transition fitting shall be used at the roof level to change from aluminum roof conductor to copper downlead cable.

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/ERECTION

A. All equipment shall be installed in a neat workmanlike manner in the most inconspicuous manner possible. The system shall consist of a complete cable network on the roof including all air terminals, splices, and bonds with cable downleads routed concealed either directly in the building construction for a new structure or in conduit to ground for an existing structure.

B. The copper downlead cables shall not be brought directly through the roof. Through roof connectors with solid rods or conduits though pitch pockets shall be utilized for this purpose.

C The limitations on areas of usage for aluminum cables and for copper and aluminum materials together as outlined in UL 96A and NFPA 780 shall be observed. The lightning protection installer will work with other trades to ensure a correct, neat, and unobtrusive installation.

D. It shall be the responsibility of the lightning protection installer to assure a sound bond to the metallic main water service and to assure interconnection with other building ground systems, including both telephone and electrical and also to ensure that proper arresters have been installed on the power service.

E. Downlead conductors from roof to ground shall be protected from mechanical damage from a point 8 feet above to 1 foot below grade by conduit or other means.

F. The lightning protection installer shall secure and deliver a UL Master Label to the Engineer for the Owner for each structure upon completion of the installation.

G. The Contractor shall also submit as-built shop drawings, with the UL Master Label Application Form.

H A permanent plate shall be affixed to each protected structure in a prominent location, indicating its UL approval, using tamper proof security fasteners.

END OF SECTION 264113

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SECTION 264313 – SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

Per Addendum No. 1 *(4/27/15)*

Q7: *Specification section 264313 Surge Protective Devices calls out a NEMA1 rating. These are to be installed in the Sodium Hypochlorite Building. Is this the correct NEMA rating?*

A7: *No, the surge protective device shall be NEMA 4X enclosed.*

1.1 SCOPE OF WORK

A. The specified unit(s) shall provide effective high energy surge suppression, surge current diversion, and high frequency noise attenuation in all electrical modes for equipment connected downstream from the SPD unit. The unit(s) shall be connected in parallel with the facility's wiring system.

B. All products that are submitted according to these specifications will be required to meet this specification in its entirety. Any product that is submitted and does not comply with all parts of this specification will be subject to rejection.

C. Instrumentation Transient Suppressors

1. Transient suppressors are intended for use on all instrument control loops for power and signal protection on transmitters/receivers, etc., and shall be furnished and installed as specified in Division 33.

D. Type 1 SPD (Secondary Power Arrestors) (480, 240, or 240/120 Volts)

1. Type 1 Surge Protective Devices shall be furnished and installed on all control equipment supplied as outlined on the Contract Drawings.

E. Type 2 SPD (Transient Voltage Surge Suppressors) (480, 240, or 240/120 Volts)

1. Type 2 Surge Protective Devices shall be furnished and installed in all Power Distribution Panels and on all equipment supplied having solid state components as the central control/monitoring device. These shall included, but not be limited to, computer systems, level control systems, and/or variable speed equipment. They shall be shown on the Drawings where required.

F. Service entrance SPD's shall be listed to be used as part of a UL master labelled lightning protection system.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Air Terminal Systems are specified in Section 264113.

1.3 SUBMITTALS

A. Provide UL1449 Third Edition listing documentation including Voltage Protection Ratings for all modes of protection, Short Circuit Current Rating (SCCR), Maximum Continuous Operating Voltage Rating (MCOV), and Nominal Discharge Current (I-n) Rating.

B. Indicate the type of internal or external fusing that is incorporated in the TVSS system and what impact the fusing has on the performance of the device with respect to surge capacity and clamping levels.

C. Provide independent third party testing documentation demonstrating that the TVSS is capable of surviving the specified maximum 8x20 μs surge current pulse without suffering performance degradation or more than 10 percent.

D. Submittals shall include shop drawings including manufacturer installation instruction manual and line drawings detailing dimensions and weight of enclosure, internal wiring diagram illustrating all modes of protection in each type of SPD required, wiring diagram showing all field connections and manufacturer's recommended wire and breaker sizes.

1.4 STANDARDS

A. Underwriters laboratories 1449 - (UL 1449 3rd edition or current safety standard for transient voltage surge suppressors)

1. Underwriters laboratories 1283 - (UL 1283 listed as an electromagnetic interference filter that provides noise attenuation)
2. Underwriters laboratories 67 - (UL 67 internal integration of TVSS in panelboard)

B. National electrical code latest edition - (NEC article 285 TVSS installation practice/NEC article 250 grounding)

1. NFPA-780 and CSA - (National Fire Protection Association)
2. ISO 9001:2000 - quality standard / military standards (mil-std 220a)

C. IEEE (Institute of Electrical and Electronic Engineering Inc.) C62.41.1 and C62.41.2 – 2002 rev. - (system shall be designed to meet C62.41)

1. IEEE C62.41.2-2002 section 7.2 long duration 10 x 1,000 μsec test to be compliant if the device exhibits less than 10 percent deviation from initial readings. Units must be tested to withstand and pass the 10 x 1,000 μsec test
2. IEEE C62.45 – 2002 rev. - (system shall be tested to meet the C62.45)
3. Category A & B - (0.5 μs x 100 kHz ring wave)
4. Category B3 bi-wave - (8 x 20 μs at 3,000 amperes and 1.2 x 50 μs at 6,000 volts)
5. Category C3 bi-wave - (8 x 20 μs at 10,000 amperes and 1.2 x 50 μs at 20,000 volts)

D. CBEMA (ITIC) and IEC - (Computer Business Equipment Manufacturers Association or Information Technology Industry Council and International Electrotechnical Commission define clamping voltage tolerance guidelines for sensitive equipment)

E. All manufacturers must comply with above listed standards and any current revisions of industry standards. All products that do not comply with current industry standards will not be accepted.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Type 1 SPD (Secondary Power Arrestors)

1. "Dale," "General Electric," or equal.

B. Type 2 SPD (Transient Voltage Surge Suppressor)

1. "Atlantic Scientific Corporation," "LEA International," "Current Technology," "Advanced Protection Technologies," or equal.

2.2 EQUIPMENT

A. Type 1 SPD (Secondary Power Arrestors)

1. The arrestor shall be hermetically sealed with pre-ionized spark gap. The unit shall be capable of repeated overvoltages without significant change in breakdown level or insulation resistance. The arrestor shall be capable of mounting in any position and shall be capable of mounting through a box knockout with standard locknuts, and shall be weatherproof.
2. Capacitance shall be less than 50 picofarads, and insulation resistance shall be at least 100 megohms. Maximum arc-over with 10 KV/micro second rise time pulse applied shall be 1,500 volts. The arrestor shall be capable of withstanding repeated application of 10 kiloampere current surges and extinguish power-follow current in 2 cycle or less. Maximum voltage between terminals shall be 2,500 volts when conducting 10 kiloampere current surges.
3. Operating temperature range shall be -40 degrees Celsius to +75 degrees Celsius.

B. Type 2 SPD (Transient Voltage Surge Suppressors)

1. The nominal operating voltage and configuration shall be as indicated on the contract drawings.
2. Declared Maximum Continuous Operating Voltage (MCOV) shall be greater than 115 percent of the nominal system operating voltage and in compliance with test and evaluation procedures outlined in the nominal discharge surge current test of UL1449 3rd Edition.
3. SPD shall be UL labeled with 20kA Inominal (I-n) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
4. The system shall provide a noise filtering system capable of attenuating noise levels produced by electromagnetic interference and radio frequency interference. The system's filtering characteristics shall be expressed in decibels (dB) of attenuation per NEMA LS1

publication. The noise filtering system shall also be UL 1283 listed as an Electromagnetic Interference Filter.

5. SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
6. Unit shall have not more than 10 percent deterioration or degradation of the UL1449 3rd Edition Voltage Protective Rating (VPR) due to repeated surges.
7. The unit shall be UL 1449 3rd Edition Listed. The UL 1449 3rd Edition voltage protection ratings (VPR) for the unit including integral disconnect shall be equal to or below the following values:

UL 1449 3rd Edition Voltage Protection Ratings (VPR)				
System Voltage	Mode of Protection			
	L-N	L-G	N-G	L-L
120/240	700	700	900	1000
120/208	700	700	500	700
277/480	1000	1200	1200	1800

8. The maximum single-pulse surge current capacity per mode shall be verified through testing at an independent third party testing facility and shall be conducted per NEMA LS-1-1992 (R2000), paragraphs 2.2.9 and 3.9. The unit shall be tested in all modes at rated surge currents and all tested modes shall be from the same test sample. This test shall include all components of the system, including disconnects (if applicable), fusing, and monitoring as a completed assembly. Individual component testing, module testing only, or subsystem testing of the unit for compliance with this section will not be acceptable. Testing that causes damage to the device, fuse operation, or voltage clamping performance degradation by more than 10 percent is not acceptable.
9. The fusing elements must be capable of allowing the suppressor's rated single impulse current to pass through the suppressor at least one time without failure. The system shall be tested to 1,000 sequential per C62.45-2002 section B.38 referencing C62.41.1 and C62.41.2 category C3 combination wave transients. The category C3 combination wave is defined as a 1.2 x 50 microsecond wave at 20,000 volt open circuit voltage waveform and 8 x 20 microsecond wave at 10,000 ampere short circuit current waveform. In addition, the system components shall be tested repetitively 1,000 times testing based on an IEEE C62.33 (MOV test) and C62.35 (SAD test) without failure or degradation exceeding ±10 percent.
10. Service Entrance Suppressors

    a. Equipment shall Equipment shall be a multi-stage parallel protector rated for 480Y/277. See online diagram and panelboard schedule to confirm voltages. The equipment's minimum surge current capacity shall be 200kA per mode (L-N, L-G, L-L and N-G).
    b. The system protection modules shall contain a technology that utilizes a symmetrical array of balanced metal oxide varistors (MOV). Each MOV will be individually coordinated to pass UL 1449.
    c. All primary transient paths shall utilize copper wire, aluminum bus bar and lugs of equivalent capacity to provide equal impedance interconnection between phases. No plug-in module or components shall be used in surge carrying paths.
    d. Each protection module shall have a visual indicator that signifies that the protection circuitry is on line. The unit shall not be taken off line to verify integrity of system. Redundant status indicators shall be mounted on the front of

the door that monitors the system protection circuitry (or be visible through the enclosure front).

e. The system shall be modular with field replaceable modules. Modular units shall contain a minimum of one module per phase.

f. Equipment shall utilize a NEMA 1 enclosure.

11. Panelboard Suppressors & Auxiliary Panel Suppressors

a. Device shall meet all specification requirements for service entrance suppressors except as follows:

1) Equipment shall be a multi-stage parallel protector rated for 480Y/277 or 208Y/120. See online diagram and panelboard schedule to confirm voltages. The equipment's minimum surge current capacity shall be 100kA per mode (L-N, L-G, L-L and N-G).

2) The system protection shall contain a technology that utilizes a symmetrical array of balanced metal oxide varistors (MOV). Each MOV will be individually coordinated to pass UL 1449. The unit shall be non-modular type.

3) Equipment shall utilize a NEMA 1 enclosure.

12. Accessories

a. Device Monitoring

1) As a minimum, device monitoring shall include: Audible alarm with alarm disable switch, surge counter, and two sets of Form C contacts for remote monitoring.

b. Integral Disconnect Switch

1) The unit shall include an integral safety interlocked disconnect located in the unit enclosure with an externally mounted manual operator. If fuses are included with this switch, the fusing shall not effectively lower the rating of the TVSS unit.

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/ERECTION

A. Where the TVSS unit is not specified with an integral safety/disconnect switch an appropriately sized disconnect switch or thermal magnetic breaker shall be installed before and in-line with the TVSS. It shall be capable of electrically isolating the TVSS from the electrical service for repair without interrupting service to the building. If a safety/disconnect switch is utilized the switch shall be rated for 600VAC. If fuses are included with this switch, the fusing shall not effectively lower the rating of the TVSS unit and shall have a minimum interrupt rating of 200kAIC. Connection means utilizing breakers shall be sized at 60A/3P and 30A/3P respectively for service entrance/switchboard/switchgear and branch panelboard units unless otherwise recommended by manufacturer.

B. The specified TVSS system shall be installed with #6 AWG minimum copper conductors (for 60A units - #10 AWG for 30A units) tapped from the electrical power distribution system. The conductors are to be as short and straight as practically possible and shall not exceed 5 electrical feet from the power conductor(s) it is protecting for service entrance/switchboard/switchgear units and 1.5 electrical feet for branch panelboard units, and shall avoid any unnecessary or sharp bends. The input conductors are to be twisted together to reduce the TVSS system inductance.

C. The TVSS shall be installed following the TVSS manufacturer's recommended practices and in compliance with these specifications and all applicable codes.

3.2 WARRANTY

A. Manufacturer shall provide a full 5-year limited warranty against failure or workmanship defects when installed in compliance to the manufacturer's written installation instructions, UL listing requirements and the National Electrical Code.

END OF SECTION 264313

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, LED lamps, and LED drivers.
2. Emergency lighting units.
3. Lighting fixture supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. LER: Luminaire efficacy rating.

D. Lumen: Measured output of lamp and luminaire, or both.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Energy-efficiency data.
4. Life, output (lumens, CCT, and CRI), and energy-efficiency data for LED lamps.
5. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.

b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

B. Product Certificates: For each type of driver dimmer-controlled fixtures, from manufacturer.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fixture-mounted, emergency battery pack: One of each type and rating installed.
2. LED Driver: One of each type and rating installed.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.9 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

A. The manufacturer shall provide a warranty against loss of performance and defects in materials and workmanship for the Luminaires for a period of 5 years after acceptance of the Luminaires. Warranty shall cover all components comprising the luminaire. All warranty documentation shall be provided to customer prior to the first shipment.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply) and integral controls as per this specification.

B. Each luminaire shall be designed to operate at an average operating temperature of 25°C.

C. Each luminaire shall meet all parameters of this specification throughout the minimum operational life when operated at the average operating temperature.

D. The operating temperature range shall be 0°C to +25°C.

E. Metal Parts: Free of burrs and sharp corners and edges.

F. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

H. Diffusers:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

    a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
    b. UV stabilized.

I. Luminaire Construction:

1. Luminaire housing to have no visible welding, screws, springs, hooks, rivets, bare LED's or plastic supports.
2. The luminaire shall be a single, self-contained device, not requiring on-site assembly for installation. The power supply and circuit board for the luminaire shall be integral to the unit.

2.2 LED LUMINAIRES

A. LED Lamps

1. LED's shall be manufactured by Nichia, Samsung, Osram or equal.

    a. Lumen Output – minimum initial lumen output of the each luminaire shall be as specified in light fixture schedule.

2. Lumen output shall not decrease by more than 20% over the minimum operational life of 50,000 hours.
3. Individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
4. LED Boards shall be suitable for field maintenance or service from below the ceiling with plug-in connectors. LED boards shall be upgradable.
5. Light Color/Quality

    a. Correlated Color temperature (CCT) shall be 4100K, unless otherwise indicated.
    b. The color rendition index (CRI) shall be 80 or greater.
    c. Color shift over 6,000 hours shall be <0.007 change in u' v' as demonstrated in IES LM80 report.

B. Drivers

1. Driver shall be > 80% efficient at full load across all input voltages. Input wires shall be 18AWG solid copper minimum.
2. Driver shall be suitable for full-range dimming. The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100% to 5% of rated lumen output with a smooth shut off function.

3. Dimming shall be controlled by a 0-10V signal.
4. Driver shall be UL listed.
5. Maximum stand-by power shall be 1 Watt.
6. Driver disconnect shall be provided where required to comply with codes. The electronics/power supply enclosure shall be internal to the luminaire and be accessible per UL requirements.
7. The surge protection which resides within the driver shall protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C64.41 2002 for Location Category A, where failure does not mean a momentary loss of light during the transient event.

C. Electrical

1. Operation Voltage - The luminaire shall operate from a 50 or 60 HZ ±3 HZ AC line over a voltage ranging from 120 VAC to 277 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.
2. Power Factor: The luminaire shall have a power factor of 90% or greater at all standard operating voltages and full luminaire output.
3. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 percent at any standard input voltage.
4. Surge Suppression: The luminaire shall include surge protection to withstand high repetition noise and other interference.
5. RF Interference: The luminaire and associated on-board circuitry must meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 Non-Consumer requirements for EMI/RFI emissions.
6. Electrical connections between normal power and driver must be modular utilizing a snap fit connector. All electrical components must be easily accessible after installation and be replaceable without removing the fixture from the ceiling.
7. All electrical components shall be RoHS compliant.

D. Photometric Requirements

1. Luminaire performance shall be tested as described herein.

    a. Luminaire performance shall be judged against the specified minimum illuminance in the specified pattern for a particular application.
    b. Luminaire lighting performance shall be adjusted (depreciated) for the minimum life expectancy.
    c. The performance shall be adjusted (depreciated) by using the LED manufacturer's data or the data from the IESNA Standard TM-21 test report, which ever one results in a higher level of lumen depreciation.

2. The luminaire may be determined to be compliant photometrically, if the initial minimum illuminance level is achieved in 100% of the area of the specified lighting pattern
3. The measurements shall be calibrated to standard photopic calibrations.

E. Thermal Management

1. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.

2. The LED manufacturer's maximum junction temperature for the expected life shall not be exceeded at the average operating ambient.
3. The LED manufacturer's maximum junction temperature for the catastrophic failure shall not be exceeded at the maximum operating ambient.
4. The luminaire shall have an UL IC rating.
5. The Driver manufacturer's maximum case temperature shall not be exceeded at the maximum operating ambient. Thermal management shall be passive by design. The use of fans or other mechanical devices shall not be allowed.

2.3 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: 3-Year sealed, maintenance-free, lead-calcium battery.

    a. Charger: 3 rate with temperature compensation.
    b. Runtime: 90 minutes, initial margin of 125 percent at 25° C.

2. Construction: NEMA Type 4X enclosure, heavy-duty, polycarbonate clear housing lens and polycarbonate housing, sealed, gasketed and corrosion resistant.

3. Features:

    a. 36 Watts of pure sine wave output
    b. Compatible with all lighting loads including LED
    c. Unique output overload designed to withstand initial load inrush up to 250%
    d. Smart self-diagnostic circuit standard
    e. Low battery indicator
    f. Wall-mounted
    g. Transfer time: 50ms
    h. Voltage: 120 VAC
    i. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    j. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    k. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.4 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

C. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

D. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.3 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner.

END OF SECTION 265100

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DIVISION 31

EARTHWORK

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SECTION 312000 - EARTHWORK

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all materials, labor, equipment and services necessary to do all clearing and grubbing, excavation, backfilling, providing of additional fill material and topsoil, control of surface drainage and ground water, finished site grading and erosion control required to construct the work as shown.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. State and local code requirements shall control the disposal of trees and shrubs.

B. All burning shall be controlled by applicable local regulations.

C. Geotechnical Exploration Report: Section 003132

D. Erosion and Sedimentation Control: Section 312500

E. Excavation Support and Protection: Section 315000

1.3 JOB CONDITIONS

A. Weather: Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained on account of rain, snow, ice, drought or other adverse weather conditions.

B. Existing Utilities: Prior to commencement of work, the Contractor shall locate existing underground utilities in areas of the work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

C. Use of Explosives: The Contractor (or any of its Subcontractors) shall not bring explosives onto site or use in work without prior written permission from the Owner. All activities involving explosives shall be in compliance with the rules and regulations of the State Department of Mines, and Minerals, Division of Explosives and Blasting. Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.

D. Protection of Persons and Property:

1. Barricade open excavations occurring as part of this work and post with warning lights.

a. Operate warning lights as recommended by authorities having jurisdiction.
b. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

E. Dust Control: Use all means necessary to control dust on or near the project site where such dust is caused by the Contractor's operations or directly results from conditions left by the Contractor.

1.4 UTILITY LINE ACTIVITIES COVERED UNDER NATIONWIDE PERMIT # 12

All activities involving utility line construction covered under NATIONWIDE PERMIT # 12 shall meet the following conditions:

A. The general Water Quality Certification is limited to the crossing of intermittent and perennial streams by utility lines.

B. The construction of permanent or temporary access roads will impact less than 300 linear feet of intermittent and perennial streams and less than one acre of jurisdictional wetlands.

C. Utility lines shall be located at least 50 feet away from a stream which appears as a blue line on a USGA 7 ½ minute topographic map except where the utility line alignment crosses the stream. Utility lines that cross streams shall be constructed by methods that maintain normal stream flow and allow for a dry excavation. Water pumped from the excavation shall be contained and allowed to settle prior to re-entering the stream. Excavation equipment and vehicles shall operate outside of the flowing portion of the stream. Spoil material from the utility line excavation shall not be allowed to enter the flowing portion of the stream.

D. The activities shall not result in any permanent changes in preconstruction elevation contours in waters or wetlands or stream dimension, pattern or profile.

E. Utility line construction projects through jurisdictional wetlands shall not result in conversion of the area to non-wetland status.

F. Measures shall be taken to prevent or control spills of fuels, lubricants, or other toxic materials used in construction form entering the watercourse.

G. Removal of riparian vegetation in the utility line right-of-way shall be limited to that necessary for equipment access. Effective erosion and sedimentation control measures must be employed at all times during the project to prevent degradation of waters of the Commonwealth. Site regarding and reseeding will be accomplished with 14 days after disturbance.

H. To the maximum extent practicable, all in stream work under this certification shall be performed during low flow.

I. Heavy equipment, e.g. bulldozers, backhoes, draglines, etc., if required for this project, should not be used or operated within the stream channel. In those instances where such in stream work is unavoidable, then it shall be performed in such a manner and duration as to minimize turbidity and disturbance to substrates and bank or riparian vegetation.

J. Any fill shall be of such composition that it will not adversely affect the biological, chemical, or physical properties of the receiving waters and/or cause violations of water quality standards. If riprap is utilized, it is to be of such weight and size that bank stress or slump conditions will not be created because of its placement.

K. Removal of existing riparian vegetation should be restricted to the minimum necessary for project construction.

L. Should evidence of stream pollution or jurisdictional wetland impairment and/or violations of water quality standards occur as a result of this activity (either from a spill or other forms of water pollution), the Kentucky Division of Water shall be notified immediately by calling 800/928-2380.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Definitions:

1. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, SP, GC, SC, ML, and CL.
2. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups MH, CH, OL, OH and PT. The Contractor shall notify the Engineer if these soil materials are encountered.
3. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand.
4. Drainage Fill: Washed, evenly graded mixture of crushed stone, or uncrushed gravel, with 100 percent passing a 1/2 inch sieve and not more than 5 percent passing a No. 4 sieve.
5. Backfill and Fill Materials: Satisfactory soil materials free of debris, waste, frozen materials, vegetable, and other deleterious matter.

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

A. Work shall consist of cutting and removing designated trees, stumps, brush, logs, removal of fences, or other loose and projecting material. Unless otherwise specified, it shall also include the grubbing of stumps, roots, and other natural obstructions which, in the opinion of the Engineer, must be removed to execute properly the construction work and operate properly the facility upon the completion of construction.

B. Trees, bushes, and all natural vegetation shall only be removed with the approval of the Engineer. No cleared or grubbed materials shall be used in backfills or embankment fills. All stumps, roots, and other objectionable material shall be grubbed up so that no roots larger than 3 inches in diameter remain less than 18 inches below the ground surface. All holes and depressions left by grubbing operations shall be filled with suitable material and compacted to grade, as recommended in Paragraph 3.06.

C. Disposal shall be by burning or other methods satisfactory to the Engineer; however, burning will be permitted only when the Contractor has obtained written permission from the local regulatory agency.

D. The Contractor shall also remove from the site and satisfactorily dispose of all miscellaneous rubbish including, but not limited to, masonry, scrap metal, rock, pavement, etc., that is under the fill or to be removed as shown on the Drawings, specified herein, or directed by the Engineer.

E. Existing improvements, adjacent property, utility and other facilities, and trees, plants, and brush that are not to be removed shall be protected from injury or damage resulting from the Contractor's operations.

F. Trees and shrubs, designated to remain or that are beyond the clearing and grubbing limit, which are injured or damaged during construction operations shall be treated or replaced at the Contractor's expense by experienced tree surgery personnel.

3.2 EROSION CONTROL

A. Temporary measures shall be applied throughout the construction period to control and to minimize siltation to adjacent properties and waterways. Such measures shall include, but not be limited to, the use of berms, silt barriers, gravel or crushed stone, mulch, slope drains and other methods.

B. These temporary measures shall be applied to erodible material exposed by any activity associated with the construction of this project.

C. Refer to Section 312500, Erosion and Sedimentation Control for requirements.

3.3 EXCAVATION

A. Excavation of every description and of whatever substances encountered within the grading limits of the project shall be performed to the lines and grades indicated on the Drawings. All excavation shall be performed in the manner and sequence as required for the work.

B. All excavated materials that meet the requirements for fill, subgrades or backfill shall be stockpiled within the site for use as fill or backfill, or for providing the final site grades. Where practicable, suitable excavated material shall be transported directly to any place in the fill areas within the limits of the work. All excavated materials that are not suitable for fill, and any surplus of excavated material that is not required for fill shall be disposed of by the Contractor.

C. The site shall be kept free of surface water at all times. The Contractor shall install drainage ditches, dikes and shall perform all pumping and other work necessary to divert or remove rainfall and all other accumulations of surface water from the excavations. The diversion and removal of surface water shall be performed in a manner that will prevent flooding and/or damage to other locations within the construction area where it may be detrimental. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hose piping, well points, deep wells, etc., necessary to depress and maintain the ground water level at least two (2) feet below the base of the excavation during all stages of construction operations. The ground water table shall be lowered in advance of excavation and maintained a minimum of two (2) feet below the lowest excavation subgrade made until the excavation is backfilled or the structure has sufficient strength and weight to withstand horizontal and vertical soil and water pressures from natural ground water.

D. Excavations for concrete structural slabs on grade shall follow the recommendations of the Geotechnical Exploration Report contained in Appendix A. Concrete mud mat(s) shall be placed across the entire footprint of the proposed building's mat foundation as described in the geotechnical report and indicated on the Drawings.

E. Excavations for the construction shall be carefully made to the depths required. Bottoms for footings and grade beams shall be level, clean and clear of loose material, the lower sections true to size. Bottoms of footings and grade beams, in all locations, shall be at the depths below proposed exterior grades as indicated in the Geotechnical Exploration Report. Footings and grade beam bottoms shall be inspected by the Engineer before any concrete is placed thereon.

F. In excavations for structures where, in the opinion of the Engineer, the ground is spongy or otherwise unsuitable for the contemplated foundation, the Contractor shall remove such unsuitable material and replace it with suitable material properly compacted.

G. Sheeting and shoring shall be provided as necessary for the protection of the work and for the safety of the personnel. The clearances and types of the temporary structures, insofar as they affect the character of the finished work, will be subject to the review of the Engineer, but the Contractor shall be responsible for the adequacy of all sheeting, bracing and cofferdamming. All shoring, bracing and sheeting shall be removed as the excavations are backfilled in a manner such as to prevent injurious caving; or, if so directed by the Engineer, shall be left in place. Sheeting left in place shall be cut off 18 inches below the surface.

H. Excavation for structures which have been carried below the depths indicated without specific instructions shall be refilled to the proper grade with suitable material properly compacted, except that in excavation for columns, walls or footings, the concrete footings shall extend to this lower depth. All work of this nature shall be at the Contractor's expense.

3.4 FILL

A. All existing fill below structures and paved areas must be stripped. Recommendations from the Geotechnical Exploration Report shall be followed for initial preparation of the site and earthwork operations.

B. All vegetation, such as roots, brush, heavy sods, heavy growth of grass and all decayed vegetable matter, rubbish and other unsuitable material within the area upon which fill is to be placed shall be stripped or otherwise removed before the fill is started. In no case will such objectionable material be allowed to remain in or under the fill area. Existing fill from excavated areas on site shall be used as fill for open and/or planted areas. Additional fill stockpiled at the site can be used for structural fill if approved by the Engineer. Any additional material necessary for establishing the indicated grades shall be furnished by the Contractor and approved by the Engineer. All fill material shall be free from trash, roots and other organic material. The best material to be used in fills shall be reserved for backfilling pipe lines and for finishing and dressing the surface. Material larger than 3 inches maximum dimension shall not be permitted in the upper 6 inches of the fill area. Fill material shall be placed in successive layers and thoroughly tamped or rolled in a manner approved by the Engineer in accordance with the recommendations from the Geotechnical Exploration Report, each layer being moistened or dried such that the specified degree of compaction shall be obtained. No fill shall be placed or compacted in a frozen condition or on top of frozen material. No fill material shall be placed when free water is standing on the surface of the area where the fill is to be placed

and no compaction of fill will be permitted with free water on any point of the surface of the fill to be compacted.

C. Where concrete slabs are placed on earth, all loam and organic or other unsuitable material shall be removed. Where fill is required to raise the subgrade for concrete slabs to the elevations as indicated on the Drawings or as required by the Engineer, such fill shall consist of suitable material and shall be placed in layers as recommended by the Geotechnical Exploration Report. Each layer shall be moistened or dried such that the specified degree of compaction shall be obtained. All compaction shall be accomplished in a manner and with equipment as approved by the Engineer. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for adjacent fill.

3.5 BACKFILLING

A. After completion of footings, grade beams and other construction below the elevation of the final grades and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all trash and debris. Material for backfilling shall be as specified for suitable material, placed and compacted as specified hereinafter and in the Geotechnical Exploration Report. Backfill shall be placed in horizontal layers of the thickness specified and shall have a moisture content such that the required degree of compaction is obtained. Each layer shall be compacted by mechanical tampers or by other suitable equipment approved by the Engineer to the specified density. Special care shall be taken to prevent wedging action or eccentric loading upon or against the structure. Trucks and machinery used for grading shall not be allowed within 45 degrees above the bottom of the footings or grade beams.

B. The trenches shall be backfilled following visual inspection by the Engineer and prior to pressure testing. The trenches shall be carefully backfilled with the excavated materials approved for backfilling, or other suitable materials, free from large clods of earth or stones. Each layer shall be compacted to a density at least equal to that of the surrounding earth and in such a manner as to permit the rolling and compaction of the filled trench with the adjoining earth to provide the required bearing value, so that paving, if required, can proceed immediately after backfilling is completed.

3.6 COMPACTION

A. Suitable material as hereinbefore specified and recommended in the Geotechnical Report shall be placed in maximum 8" horizontal layers. Compaction shall be performed by rolling with approved tamping rollers, pneumatic-tired rollers, three wheel power rollers or other approved equipment. The degree of compaction required is expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D-698. Laboratory moisture density tests shall be performed on all fill material. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction. Compaction requirements shall be as specified in the Geotechnical Exploration Report.

B. Field density tests shall be performed in sufficient number to insure that the specified density is being obtained. Tests shall be in accordance with ASTM Standards D 1556 or D 2922/D 3017 and shall be performed as authorized by the Engineer. Payment for field density tests shall be

by the Contractor. Contractor shall provide suitable notification for coordination of testing. Delays due to the lack of adequate advance notification shall be the responsibility of the Contractor.

3.7 SITE GRADING

A. Where indicated or directed, topsoil shall be removed without contamination with subsoil and spread on areas already graded and prepared for topsoil, or transported and stockpiled convenient to areas for later application, or at locations specified. Topsoil shall be stripped to full depth and, when stored, shall be kept separate from other excavated materials and piled free of roots, stones, and other undesirable materials.

B. Site grading and earthwork operations shall follow recommendations in the Geotechnical Exploration Report.

C. In general and unless otherwise specified, the Contractor may use any type of earth moving equipment it has at its disposal, provided such equipment is in satisfactory condition and of such type and capacity that the work may be accomplished properly and the grading schedule maintained. During construction, the Contractor shall route equipment at all times, both when loaded and empty, over the layers as they are placed, and shall distribute the travel evenly over the entire area.

D. The material in the layers shall be of the proper moisture content before rolling or tamping to obtain the prescribed compaction. Wetting or drying throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on the fill thus affected shall be delayed until the material has dried to the required moisture content. If the material is too dry, it shall be sprinkled with water and manipulated to obtain the uniform moisture content required throughout a layer before it is compacted.

E. Each layer of the fill shall be compacted by rolling or tamping to the standard specified in Geotechnical Exploration Report as determined by field density tests made by the Standard Proctor method. In general and unless otherwise specified, the Contractor may use any type of compaction equipment such as sheepsfoot rollers, pneumatic rollers, smooth rollers and other such equipment it has at its disposal, provided such equipment is in satisfactory condition and is of such design, type, size, weight, and quantity to obtain the required density in the embankment. If at any time the required density is not being obtained with the equipment then in use by the Contractor, the Engineer may require that different and/or additional compaction equipment be obtained and placed in use at once to obtain the required compaction.

F. The Contractor shall be responsible for the stability of all embankments and shall replace any portion which, in the opinion of the Engineer, has become displaced due to carelessness or negligence on the part of the Contractor.

3.8 TOPSOIL

A. Provide all labor, materials, equipment and services required for furnishing and placing topsoil. Samples of topsoil shall be submitted to the Engineer for review before topsoil is placed. The material shall be good quality loam and shall be fertile, friable, mellow; free from stones larger

than one (1) inch, excessive gravel, junk metal, glass, wood, plastic articles, roots and shall have a liberal amount of organic matter. Light sand loam or heavy clay loam will not be acceptable.

B. The topsoil shall be 3 inches thick in all areas to be seeded. No topsoil shall be placed until the area to be covered is excavated or filled to the required grade. Imported backfill material will be stockpiled on site for structure backfilling and top soiling.

END OF SECTION 312000

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor and equipment required to dewater all excavations.

B. Dewatering of all excavations shall be the responsibility of the Contractor, and no additional compensation will be allowed for same unless specifically included as a bid item.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork: Section 312000

B. Erosion and Sedimentation Control: Section 312500

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL

A. Dewatering equipment shall be of adequate size and quantity to assure maintaining proper conditions for installing pipe, concrete, backfill or other material or structure in the excavation.

B. Dewatering shall include proper removal of any and all liquid, regardless of its source, from the excavation and the use of all practical means available to prevent surface runoff from entering any excavation.

C. The site shall be kept free of surface water at all times. The Contractor shall install drainage ditches, dikes and shall perform all pumping and other work necessary to divert or remove rainfall and all other accumulations of surface water from the excavations. The diversion and removal of surface water shall be performed in a manner that will prevent flooding and/or damage to other locations within the construction area where it may be detrimental. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hose piping, well points, deep wells, etc., necessary to depress and maintain the ground water level at least two (2) feet below the base of the excavation during all stages of construction operations. The ground water table shall be lowered in advance of excavation and maintained a minimum of two (2) feet below the lowest excavation subgrade made until the structure has sufficient strength and weight to withstand horizontal and vertical soil and water pressures from natural ground water.

D. Dewatering operations should not discharge into the sanitary sewer system, or into any ditch, pipe or other conveyance that leads to a regulated water body, except as authorized by a KPDES permit.

END OF SECTION 312319

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SECTION 312500 - EROSION AND SEDIMENTATION CONTROL (Areas Less Than One Acre)

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, and equipment required for erecting, maintaining and removing temporary erosion and sedimentation controls as shown on the Drawings and as specified herein and as recommended by state and local regulatory agencies.

B. Temporary erosion controls include, but are not limited to grassing, mulching, seeding, providing erosion control and turf reinforcement mats on all disturbed surfaces including waste area surfaces and stockpile and borrow area surfaces; scheduling work to minimize erosion and providing interceptor ditches at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits.

C. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, and appurtenances on sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits.

D. Contractor is responsible for providing and maintaining effective temporary erosion and sediment control measures prior to and during construction or until final controls become effective.

E. The Contractor shall be responsible for placement of erosion and sedimentation controls. Prior to construction, the Contractor shall develop an erosion control plan and submit to the Engineer for review. Prior to excavation, fill or grade work, the Contractor shall place controls in locations required by the erosion control plan. If during the course of construction, the Engineer determines additional controls are required, the Contractor shall furnish, install and maintain additional mulching, blankets and/or sediment barriers to control erosion and sedimentation to the satisfaction of the Engineer.

F. The Contractor shall notify the appropriate state agency before beginning construction, and shall implement erosion control measures as may be required by state and federal agencies. If disturbed area is greater than one acre, Contractor shall submit a signed Notice of Intent form to the Division of Water at least 48 hours prior to beginning of construction activity.

G. The Contractor shall inspect and repair all erosion and sedimentation controls every seven (7) days and after each rainfall of 0.5 inch or greater.

H. Bare soil areas must be seeded, mulched, or covered after 14 days if no work will be done in the area within the next 7 days.

1.2 RELATED WORK

A. Dewatering - Section 312319.

B. Final erosion protection measures where required are included in this Section.

PART 2 – PRODUCTS

2.1 SEED

A. The seed mixture to be sown shall be in the following proportions:

Common Name	Proportion By Weight	% of Purity	% of Germination
Kentucky 31 Tall Fescue	75	90	85
Italian Rye Grass	10	90	85
Red Top	10	90	85
White Clover	5	95	90

B. All seed shall be fresh and clean and shall be delivered mixed, in unopened packages, bearing a guaranteed analysis of the seed mixture.

2.2 FERTILIZER

A. Just prior to the planting of turf, evenly broadcast 15 pounds per thousand square feet of fertilizer, 10-10-10 (nitrogen, phosphorus, potassium). Disc or harrow fertilizer 2 to 4 inches into the soil.

B. Fertilizer shall be delivered to the site in the original unopened container bearing the manufacturer's guarantee analysis. Any fertilizer that becomes caked or damaged making it unsuitable for use, will not be accepted.

2.3 SOD

A. Sod shall be at least 70% Bluegrass, strongly rooted and free of weeds.

B. It shall be mowed to a height not to exceed 3" before lifting, and shall be of uniform thickness with not over 1-1/2" of soil.

2.4 MULCH

A. Mulch for seeded areas shall be Conwed Hydro Mulch, Silva-Fiber, or equal. It shall be suitable for use in a water slurry or for application with hydraulic equipment.

B. Clean straw is acceptable as mulch. It shall be spread at the rate of one (1) bale per 1,000 feet (approximately 2" loose depth).

C. Mulch on slopes greater than 4:1 shall be held in place with erosion control netting.

D. Mulch on areas subject to surface water run-off or in drainage ditches shall be held in place with erosion control netting.

2.5 EROSION CONTROL BLANKETS

A. Erosion Control Blanket shall be made up of biodegradable and/or photodegradable products such as jute, wood fiber, coconut fiber, straw and degradable plastic netting. They shall degrade at a rate of approximately 6 months to 24 months.

B. Erosion Control Blanket shall be installed on slopes greater than 4:1 and in all ditches and drainage channels, and where otherwise indicated on the Contract Drawings or directed by regulatory agencies.

2.6 TURF REINFORCEMENT MAT

A. Where indicated on the Contract Drawings or as described in the Specifications, Turf Reinforcement Mat shall be installed for permanent erosion control.

B. Turf Reinforcement Mat shall consist of top and bottom heavy weight netting and biodegradable matrix such as coconut fiber or aspen curled wood excelsior.

C. Where slope and hydraulic conditions are severe, a synthetic matrix may be used, based on manufacturer's recommendations.

2.7 SILT FENCE

A. Temporary Silt Fence shall consist of woven geotextile fabric attached to 2" X 2" X 48" tall hardwood stakes.

1. Fabric shall be 48" tall, with top being even with top of stakes. Bottom 12" shall be buried in trench as shown on the Detail Drawings.
2. Stakes shall be at 6' centers unless stated otherwise on Contract Documents.

B. Temporary Reinforced Silt Fence

1. For areas of steep slopes and high flows, where indicated on the Contract Drawings, or as directed by state or local regulations, Reinforced Silt Fence shall be installed.
2. Fabric shall be woven monofilament geotextile attached to 11 gauge steel fencing of 2" X 4" grid.
3. Stakes shall be 5" tall steel and shall be installed on 4' centers.
4. Fabric and fencing shall be buried in trench as shown on the Detail Drawings.

C. Spacing of Silt Fences on slopes shall be according to the following table, or as directed by state or local regulatory agencies:

Slope Angle	Soil Type		
	Silty	Clays	Sandy
Very Steep (1:1)	50 ft.	75 ft.	100 ft.
Steep (2:1)	75 ft.	100 ft.	125 ft.
Moderate (4:1)	100 ft.	125 ft.	150 ft.
Slight (10:1)	125 ft.	150 ft.	200 ft.

D. If runoff flows along the uphill side of the silt fence, Contractor shall install "J-hooks" every 40 to 80 feet. These are curved sections of silt fence above the continuous fence that serve as small dams to stop and hold the flow to allow sediment to settle.

2.8 FIBER ROLLS

A. On long slopes less than 10:1, and where indicated on the Contract Drawings or recommended by the regulatory agency, Fiber Rolls shall be installed.

B. Fiber Rolls shall be made of wood shavings, coconut fiber or other similar material encased in heavy duty netting.

C. Wooden stakes at 4'-0" on center shall be used to anchor the Fiber Rolls along the contours of the slope.

2.9 AGGREGATE SILT CHECKS

A. Where needed to slow flow velocity, to cause ponding or to protect storm water inlet structures, Aggregate Silt Checks shall be installed.

B. Aggregate Silt Checks shall consist of rock of various sizes ranging from 2" to 6" contained in or placed on geotextile filter fabric. Pea-stone or gravel-filled bags are acceptable for temporary silt checks in low-flow conditions.

2.10 RIP RAP

A. Rip Rap shall be installed at the outlets of storm drains and on channel banks as noted on the Contract Drawings and/or recommended by state and local regulatory agencies.

B. Rip Rap shall have no less than 80%, by volume, of individual stones that range in size from 0.0247 to 1.483 cubic feet.

2.11 CONSTRUCTION ENTRANCE PAD

A. Contractor shall construct entrance pads at all locations where vehicles will enter or exit the site.

B. Pad shall be a minimum of 20 feet wide, 50 feet long and 6" thick, and consist of No. 2 stone laid on top of filter fabric.

PART 3 - EXECUTION

3.1 GENERAL

A. Erosion and sediment control practices shall be consistent with the requirements of the state and local regulatory agencies and in any case shall be adequate to prevent erosion of disturbed and/or regraded areas.

B. Contractor is responsible for notifying the state regulatory agency concerning inclusion under the NPDES General Permit for Storm Water Discharges From Construction Activities.

C. Gravity sewer lines and force mains that cross steams shall be constructed by methods that maintain normal stream flow and allow for a dry exaction. Water pumped from the excavation shall be contained and allowed to settle prior to reentering the stream. Excavation equipment and vehicles shall operate outside of the flowing portion of the stream. Spoil material from the sewer line excavation shall not be allowed to enter the flowing portion of the stream. The provisions of this condition shall apply to all types of utility line stream crossings.

D. Removal of riparian vegetation in the utility line right-of-way shall be limited to that necessary for equipment access. Effective erosion and sedimentation control measures must be employed at all times during the project to prevent degradation of waters of the Commonwealth. Site regrading and reseeding will be accomplished with 14 days after disturbance.

3.2 SEEDING

A. The areas to be seeded shall be thoroughly tilled to a depth of at least 4" by discing, harrowing, or other approved methods until the condition of the soil is acceptable to the Engineer. After harrowing or discing, the seed bed shall be dragged and/or hand raked to finish grade.

B. The incorporation of the fertilizer and the agricultural lime may be a part of the tillage operation and shall be applied no less than 24 hours nor more than 48 hours before the seed is to be sown.

C. Seed shall be broadcast either by hand or approved sowing equipment at the rate of ninety (90) pounds per acre (two pounds per 1,000 square feet), uniformly distributed over the area. Broadcasting seeding during high winds will not be permitted. The seed shall be drilled or raked into a depth of approximately 2 inch and the seeded areas shall be lightly raked to cover the seed and rolled. Drilling seeding shall be done with approved equipment with drills not more than 3 inches apart. All ridges shall be smoothed out, and all furrows and wheel tracks likely to develop into washes, shall be removed.

D. After the seed has been sown, the areas so seeded shall be mulched with clean straw at the rate of one (1) bale per 1,000 feet (approximately 2 inch loose depth). Mulch on slopes and in all ditches and drainage channels shall be held in place with erosion control blankets.

E. Areas seeded shall be watered and protected until a uniform stand develops, and then inspected periodically and maintained appropriately. Displaced mulch shall be replaced or any damage to the seeded area shall be repaired promptly, both in a manner to cause minimum disturbance to the existing stand of grass. If necessary to obtain a uniform stand, the Contractor shall

refertilize, reseed and remulch as needed. Scattered bare spots up to one (1) square yard in size will be allowed up to a maximum of 10 percent of any area.

F. Payment for seeding and mulching shall be included in the Contractor's bid.

3.3 SOD

A. To install, bring soil to final grade and clear of trash, wood, rock, and other debris. Apply topsoil, fertilizer at approximately 1000 lbs per acre.

B. Use sod within 36 hours of cutting. Lay sod in straight lines. Butt joints tightly, but do not overlap joints or stretch sod. Stagger joints in adjacent rows in a brickwork type pattern. Use torn or uneven pieces on the end of the row.

C. Notch into existing grass. Anchor sod with pins or stakes if placed on slopes greater than 3:1. Roll or tamp sod after installation and water immediately. Soak to a depth of 4 to 6 inches. Replace sod that grows poorly. Do not cut or lay sod in extremely wet or cold weather. Do not mow regularly until sod is well established.

3.4 INSTALLATION OF EROSION AND SEDIMENT CONTROL DEVICES

A. All erosion and sediment control products and materials shall be installed per manufacturer's recommendations and in accordance with the Kentucky Erosion Prevention and Sediment Control Field Guide.

B. Contractor shall pay special attention to the trenching-in of the bottoms of silt fence, the staking of sediment barriers, and the stapling of erosion control blankets.

3.5 MAINTENANCE OF EROSION AND SEDIMENT CONTROL DEVICES

A. Erosion and sedimentation controls shall be inspected weekly and after rain events of 0.5 inch or greater. Replace silt fencing as needed, filter stone which is dislodged, erosion control blanket which is damaged, and make other necessary repairs.

B. Remove sediment from fences and barriers when it accumulates to half the height of the barrier, or more often as needed.

3.6 CLEAN UP

A. Upon completion of the project and/or establishment of satisfactory turf, vegetation or permanent erosion control structures, Contractor shall remove all temporary devices and properly dispose of such.

END OF SECTION 312500

SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes, but is not limited to, the following:

1. Shoring and bracing necessary to protect existing buildings, streets, walkways, utilities, and other improvements and excavation against loss of ground or caving embankments.
2. Maintenance of shoring and bracing.
3. Removal of shoring and bracing, as required.

B. Types of shoring and bracing systems include, but are not limited to, the following:

1. Steel H-section (soldier) piles.
2. Timber lagging.
3. Steel sheet piles.
4. Portable Steel Trench Box.

C. Building excavation is specified in another Section.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Section 013323.

B. Layout drawings for excavation support system and other data prepared by, or under the supervision of, a qualified professional engineer. System design and calculations must be acceptable to local authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Engineer Qualifications: A professional engineer legally authorized to practice in jurisdiction where Project is located, and experienced in providing successful engineering services for excavation support systems similar in extent required for this Project.

B. Supervision: Engage and assign supervision of excavation support system to a qualified professional engineer foundation consultant.

C. Regulations: Comply with codes and ordinances of governing authorities having jurisdiction.

1.5 JOB CONDITIONS

A. Before starting work, verify governing dimensions and elevations. Verify condition of adjoining properties. Take photographs to record any existing settlement or cracking of structures, pavements, and other improvements. Prepare a list of such damages, verified by dated photographs, and signed by Contractor and others conducting investigation.

B. Survey adjacent structures and improvements, employing qualified professional engineer, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

C. During excavation, resurvey benchmarks weekly, maintaining accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer if changes in elevations occur or if cracks, sags, or other damage is evident.

1.6 EXISTING UTILITIES

A. Protect existing active sewer, water, gas, electricity and other utility services and structures.

B. Notify municipal agencies and service utility companies having jurisdiction. Comply with requirements of governing authorities and agencies for protection, relocation, removal, and discontinuing of services.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide adequate shoring and bracing materials which will support loads imposed. Materials need not be new, but should be in serviceable condition.

B. Structural Steel: ASTM A 36.

C. Steel Sheet Piles: ASTM A 328.

D. Timber Lagging: Any species, rough-cut, mixed hardwood, nominal 3 inches thick, unless otherwise indicated.

E. Portable Steel Trench Box shall be OSHA approved.

PART 3 - EXECUTION

3.1 SHORING

A. Wherever shoring is required, locate the system to clear permanent construction and to permit forming and finishing of concrete surfaces. Provide shoring system adequately anchored and braced to resist earth and hydrostatic pressures.

B. Shoring systems retaining earth on which the support or stability of existing structures is dependent must be left in place at completion of work.

3.2 BRACING

A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move a brace, install new bracing prior to removal of original brace.

B. Do not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to Engineer.

C. Install internal bracing, if required, to prevent spreading or distortion of braced frames.

D. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

E. Remove sheeting, shoring, and bracing in stages to avoid disturbance to underlying soils and damage to structures, pavements, facilities, and utilities.

F. Repair or replace, as acceptable to Engineer, adjacent work damaged or displaced through installation or removal of shoring and bracing work.

END OF SECTION 315000

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DIVISION 32

EXTERIOR IMPROVEMENTS

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SECTION 321216 – ASPHALT PAVING (KENTUCKY)

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The hot-mix asphalt paving work includes the construction of an aggregate base course, asphalt base and wearing courses as specified herein. This work is to replace paving disturbed by the construction and any damages to paving by Contractor's operations, as well as new pavement and driveways, within the limits shown on the plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions and General Requirements apply to the work specified in this section.

B. Earthwork: Section 312000

1.3 APPLICABLE STANDARDS

A. All references in this section to the Standard Specifications shall refer to the most recent Edition of Standard Specifications for Road and Bridge Construction with all amendments thereto as published by the Kentucky Transportation Cabinet (KYTC).

1.4 SUBMITTALS

A. Job-Mix Designs: For each job mix proposed for the Work.

B. Comply with the requirements of Section 013323.

1.5 QUALITY ASSURANCE

A. Hot Mix Asphalt Producer Qualifications: Engage a firm experienced in producing hot-mix asphalt similar to that indicated for this Project and with a record of successful in-service performance.

B. Producer firms shall be qualified through the Kentucky Transportation Cabinet as an approved Asphalt Mix Producing Firm.

C. Testing and inspection: The Contractor shall retain a qualified testing laboratory for testing and inspection.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp. Comply with the provisions of KYTC Standard Specifications Section 403.03.01 for temperature requirements.

B. Grade Control: Establish and maintain required lines and elevations.

PART 2 – PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Aggregate Base Course: Dense Graded Aggregate Base (DGA) complying with Section 302 and 805 of the Standard Specifications.

C. Coarse Aggregate: Sound, angular crushed stone, or crushed gravel, complying with Standard Specifications Section 805.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO MP 1, Performance Graded Binder PG 64-22 for general applications.

B. Tack Coat: Comply with provisions in KYTC Standard Specifications Section 406.

2.3 MIXES

A. Hot-Mix Asphalt: Hot-laid, hot-mix asphalt plant mixes meeting the requirements of the Standard Specifications of the Kentucky Transportation Cabinet (KYTC) or Asphalt Institute (AI) MS-2 and complying with the following requirements:

1. Base Course: Produce KYTC mixture designation Class 2 Base. There shall be no restrictions on polish resistant aggregates (utilize KYTC Type “D” aggregates). Recycled Asphalt Pavement (RAP) may be utilized in accordance with Standard Specifications Section 409.
2. Surface Course: KYTC mixture designation Class 2 Surface. The mixture gradation may pass through the restricted zone and there shall be no restriction on polish resistant aggregates (utilize KYTC Type “D” aggregates). Recycled Asphalt Pavement (RAP) may be utilized in accordance with Standard Specifications Section 409.

B. Hot-Mix Asphalt: Hot-laid, hot-mix asphalt plant mixes designed according to procedures established by the Kentucky Transportation Cabinet (KYTC) and complying with the following requirements.

1. Provide mixes complying with composition, grading, and tolerance requirements Standard Specifications for the following nominal, maximum aggregate sizes:

    a. Base Course: Mixture with a nominal maximum aggregate size of 0.75 inch with a minimum Voids in the Mineral Aggregate (VMA) of 12 percent.
    b. Surface Course: Mixture with a nominal maximum aggregate size of 0.38 inch with a minimum VMA of 14 percent.

PART 3 - EXECUTION

3.1 INSPECTION

A. Pavement installer must examine the areas excavated and backfilled and conditions under which pavement is to be constructed. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until satisfactory embankments and subgrade have been established to a uniform line, properly shaped and compacted.

B. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

C. Proof-roll subbase using loaded dump trucks or heavy rubber-tired construction equipment to locate areas that are unstable or that require further compaction.

D. Proceed with paving only after unsatisfactory conditions have been corrected.

E. Repairs to Base Course: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

F. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.2 AGGREGATE BASE COURSES

A. Place aggregate base course on subgrades free of mud, frost, snow, or ice in accordance with Section 302 of the Standard Specifications.

B. On prepared subgrade, place base course as follows:

1. Shape base course to required crown elevations and cross-slope grades.
2. Place base course that exceeds 9 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
3. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D698 or in accordance with Section 302.03.04 of the Standard Specifications.

3.3 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Tack Coat: Comply with provisions in Standard Specifications Section 406. Apply to the surface of concrete surfaces, existing asphalt surfaces and, when necessary, to newly constructed asphalt surfaces.

3.4 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Comply with applicable provisions of KYTC Standard Specifications Section 403 for delivery, placement, spreading and compaction of the mixture.

1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent.

3.5 FIELD QUALITY CONTROL

A. Thickness Tolerances: Compact each course to produce the thickness indicated within the following tolerances:

1. Aggregate and asphalt base Course: Plus or minus 1/2 inch.
2. Asphalt surface course: Plus or minus 1/4 inch.
3. Provide a minimum fall of 2% to facilitate drainage unless otherwise indicated on the Drawings.

B. Surface Smoothness: Compact each course to produce a surface smoothness with the following tolerances as determined using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Aggregate base course: 3/8 inch.
2. Asphalt base course: 1/4 inch.
3. Asphalt surface course: 1/8 inch.
4. Crowned surfaces: Test with crowned template centered and at a right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. In-Place Density: Filed density test of in-place compacted aggregate base will be determined by nuclear method in accordance with ASTM D 2940. Field density of in-place compacted pavement will be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726. Test will be made for every 1,000 square yards or less of installed pavement.

D. Core Sampling: If required to confirm either thickness tolerances or compaction of asphalt

courses, core samples shall be taken and tested according to ASTM D 3549 for thickness and ASTM D 1188 or ASTM D 2726 for compaction. Determination of need for core samples will be made by the Engineer.

END OF SECTION 321216

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SECTION 321615 - SIDEWALKS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment and services required for constructing concrete sidewalks where shown on the Drawings and as specified herein,

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Cast-In-Place Concrete: Section 033100

B. Earthwork: Section 312000

PART 2- PRODUCTS

2.1 CRUSHED STONE

A. Stone for sidewalk base shall be No. 57 aggregate, or equal.

2.2 CONCRETE

A. Concrete for sidewalks shall be 3000 psi concrete.

2.3 REINFORCEMENT

A. The minimum yield strength of the reinforcement shall be 60,000 pounds per square inch. Bar reinforcement shall conform to the requirements of ASTM A615. All bar reinforcement shall be deformed.

B. Wire-mesh reinforcement shall be continuous between expansion joints. Laps shall be at least one full mesh plus 2", staggered to avoid continuous lap in either direction, and securely wired or clipped with standard clips.

2.4 PREMOLDED EXPANSION JOINT FILLER

A. Premolded expansion joint filler shall be closed cell polyethylene foam type, Sonneborn Sonoflex F, Williams Products Expand-O-Foam, or equal. Seal joint with one-part self leveling polyurethane sealant, Sonneborn Sonolastic SL 1, or equal, maximum 3/8” deep. Prepare and prime joints per manufacturer’s instructions.

PART 3- EXECUTION

3.1 BASE

A. Following finished grading, a base course of crushed stone shall be placed to a compacted thickness of four (4) inches. Immediately prior to placing concrete, crushed stone base shall be thoroughly wetted, or the concrete placed on a layer of heavy building paper.

3.2 SURFACE

A. Concrete paving shall consist of 4 or 6 inches (as noted) of 3,000 psi reinforced concrete, struck off to accurately placed screens and worked with a float until mortar appears on the top. After surface has been thoroughly floated, it shall be brushed to leave markings of a uniform type, providing non-slip finish. No dusting or plastering will be allowed.

3.3 FINISHING

A. All joints and edges shall be finished with an edging tool. Dummy joints shall be formed about five (5) feet apart to form rectangular blocks. Expansion joints of 1/2 inch premolded expansion joint material shall be provided at the intersection of all vertical surfaces with the sidewalks slabs and at approximately 20-feet intervals along the walks.

3.4 QUALITY CONTROL

A. The allowable variation shall be 1/8 inch to 10 feet transversely and longitudinally.

END OF SECTION 321615

SECTION 323113 - CHAIN LINK SECURITY FENCES AND GATES

PART 1 - GENERAL

Per Addendum No. 1 *(4/27/15)* *Temporary Fence During Construction - Temporary fence shall be installed during construction where existing fence is removed prior to installation of permanent fencing. Specification section 323113 Chain Link Security Fences and Gates shall be followed for temporary fence material and installation except that fence posts are not required to be installed in concrete footings.*

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and service required to furnish and install chain link fencing and gates according to the layout shown on the Contract Drawings. Height of the fencing fabric shall be seven (7) feet.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Cast-In-Concrete: Section 033100

B. Earthwork: Section 312000

1.3 SUBMITTALS

A. Comply with provisions of Section 013323. At the time of submission, the Contractor shall in writing, call the Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

B. Shop Drawings:

1. Indicate details of fabrication and installation, including but not limited to fence height, post spacing, dimensions, unit weights and footing details.

C. Manufacturer's Literature:

1. Descriptive data of installation methods and procedures;
2. Standard drawings of fence and gate installation.

1.4 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Deliver materials with manufacturer's tags and labels.

B. Handle and store material as to avoid damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Framework shall conform to one of the following:
   1. Steel pipe with 1.8 ounces of zinc coating per square foot of surface area conforming to ASTM F1043 - Group IA; external coatings per F1043 paragraph 7.1.1 and internal coatings per F1043 paragraph 7.2.1.
   2. High strength steel pipe triple coated per ASTM F1043 - Group IC; external coatings per F1043 paragraph 7.1.2, and internal coatings per F1043 paragraph 7.2.4.

      a. All coatings to be applied after welding.
      b. Pipe shall be straight, true to section and shall conform to the following weights:

Pipe Size Outside Diameter	Group 1A Weight (Lbs per Ft.)	Group 1C Weight (Lbs per Ft.)
1-5/8"	2.27	1.84
2"	2.72	2.28
2-1/2"	3.65	3.12
3"	5.79	4.64
3-1/2"	7.58	5.71
4"	9.11	6.56

B. Fabric: Fabric shall be aluminized fabric manufactured in accordance with ASTM A-491 and coated before weaving with a minimum of 0.4 ounces of aluminum per square foot of surface area. The steel wire and coating shall conform to ASTM A-817. Fabric shall be 9 gauge, woven in a 2" diamond mesh. Top selvage to be twisted and barbed. Bottom selvage to be knuckled.

   1. The aluminum coated wire shall have a tensile strength of at least 80,000 pounds per square inch.

2.2 COMPONENTS

Components of the fencing system shall be in accordance with the following requirements:

A. Fence Posts:

	Group IA or Group IC	
Fabric Height	Line Post O.D.	Terminal Post O.D.
Under 6"	2"	2-1/2"
6' to 9'	2-1/2"	3"
9' to 12'	3"	4"

B. Gate Posts:

Single Gate Width	Double Gate Width	Group IA or Group IC Post O.D.
Up to 6'	Up to 12'	3"
7' to 12'	13' to 25'	4"

C. Rails and Braces: 1-5/8" O.D.

D. Fittings:

1. Post Caps: Pressed steel, cast iron or cast aluminum alloy designed to fit snugly over posts to exclude moisture. Supply cone type caps for terminal posts and loop type for line posts. All fittings to conform to ASTM F-626.
2. Rail and Brace Ends: Pressed steel, cast iron or cast aluminum alloy, cup-shaped to receive rail and brace ends.
3. Top Rail Sleeves: Tubular steel, 0.051 thickness x 7" long, expansion type.
4. Tension Bars: Steel strip, 5/8" wide x 3/16" thick.
5. Tension Bands: Pressed steel, 14 gauge thickness x 3/4" wide.
6. Brace Bands: Pressed steel, 12 gauge thickness x 3/4" wide.
7. Truss rods: Steel rod, 3/8" diameter merchant quality with turnbuckle.
8. Barbed Wire Arms: Pressed steel, cast iron or cast aluminum alloy fitted with clips or slots for attaching three strands of barbed wire. Arms shall be set outward on a 45 degree angle and be capable of supporting a 250 pound load at outer barbed wire connecting point without causing permanent deflection.

E. Tension Wire: Marcelled 7 gauge steel wire with minimum coating of 0.80 ounces of zinc or 0.40 ounces of aluminum per square foot of wire surface and conforming to ASTM A-824.

F. Tie Wires: Aluminum, 9 gauge, alloy 1100-H4 or equal.

G. Hog rings: Steel wire, 11 gauge, with a minimum zinc coating of 0.80 ounces per square foot of wire surface.

H. Barbed Wire: Commercial quality steel, 12-1/2 gauge, two strand twisted line wire with 4 point barbs at 5-inch spacing. Coating shall consist of a minimum of 0.80 ounces of zinc per square foot of wire surface conforming to ASTM A-121 or a minimum of 0.30 ounces of aluminum per square foot or wire surface conforming to ASTM A-585.

I. Razor Wire: Match existing cross type hot dipped galvanized concertina razor wire, 900mm dia. × 15meter, 0.5mm blade thickness, 2.5/3.8mm wire dia. 22 - 24mm barb length, 15mm barb width, 34mm/35mm barb spacing, weight per coil 12-15kgs

2.3 CONCRETE MIX

A. Concrete for footings shall be ASTM C-94 Portland Cement concrete with maximum 3/4" aggregate having a minimum compressive strength of 3,000 PSI at 28 days.

2.4 GATES

A. Gates shall be of the types and sizes shown on the Drawings. Gate filler fabric shall be of the same as that used in fence.

B. Frames:

1. Swing gate frames shall be of 2" outside diameter galvanized Group IA or Group IC, having corners fitted with rigid watertight heavy malleable castings or electrically welded joints. Internal bracing shall be of 1-5/8" outside diameter galvanized steel pipe, Group IA or Group IC.

C. Hinges:

1. Gate hinges shall be double clamping offset type allowing gates to swing back parallel with line of fence. They shall be malleable iron and forged steel heavily galvanized.

D. Latches and Keepers:

1. Gate latch shall be of eccentric double locking type which engage strike securely bolted to either gate frame or gate post at both top and bottom. Latches shall be readily locked with padlock.
2. Gatekeeper shall be furnished with each gate frame to automatically engage gate frame when swung to open position.

E. Gate manufacturer and supplier shall be responsible for all hardware associated with attaching gates and removable panels.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Installation to conform to ASTM F-567.

B. Post Spacing: Space line posts at intervals not exceeding ten feet.

C. Post Setting: Set terminal, gate and line posts plumb in concrete footings of the dimensions shown on the Details. Top of footing to be 2" above grade and sloped to direct water away from posts.

D. Bracing: Brace gate and terminal posts back to adjacent line posts with horizontal brace rails and diagonal truss rods.

E. Top Rail: Install through line post loop caps connecting sections with sleeves to form a continuous rail between terminal posts.

F. Top Tension Wire: If top rail is not required, stretch tension wire through loop caps and fasten to terminal posts.

G. Bottom Tension Wire: Stretch between terminal posts 6" above grade and fasten to outside of line posts with tie wires.

H. Fabric: Pull fabric taut with bottom selvage 2" above grade. Fasten to terminal posts with tension bars threaded through mesh and secured with tension bands at maximum 15" intervals. Tie to line posts and top rails with tie wires spaced at maximum 12" on posts and 24" on rails. Attach to bottom tension wire with top rings at maximum 24" intervals.

I. Barbed Wired: Anchor to terminal extension arms, pull taut and firmly install in slots of line post extension arms.

J. Gates: Install gates plumb, level and secure for full opening without interference. Anchor center stops and keepers in concrete.

K. Fasteners: Install nuts for fittings, bands, and hardware bolts on inside of fence.

3.2 COMPLETION

A. Adjust brace rails and tension rods for rigid installation.

B. Tighten hardware, fasteners, and accessories.

C. The area of installation shall be left free of debris caused by the installation of the fence.

END OF SECTION 323113

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SECTION 329200 - LAWNS AND GRASSES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, and services required for seeding of all disturbed areas caused by construction activities and for installation of sod where indicated on the Contract Drawings or specified herein.

1.2 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to Work of this Section.

B. Earthwork: Section 312000

1.3 MAINTENANCE

A. Maintenance shall begin immediately following the last operation of installation for each portion of lawn.

B. Lawns shall be maintained by watering, mowing, and for resodding for a period of forty-five (45) days. At the end of this period an inspection will be made and any deficiencies, which may be attributable to the Contractor, will be noted in writing. At this time, the Owner will assume the maintenance. Another inspection will be made at the beginning of the next planting season, and any of the previously noted deficiencies still existing shall be repaired by the Contractor.

1.4 INSPECTION FOR ACCEPTANCE

A. The Inspection of the Work:

1. The inspection of the work of lawns to determine the completion of contract work exclusive of the possible replacement of plants, will be made by the Architect/Engineer upon written notice requesting such inspection submitted by the Contractor at least ten (10) days prior to the anticipated date.

B. Acceptance:

1. After inspection, the Contractor will be notified in writing by the Owner of acceptance of all work of this Section, exclusive of the possible replacement of plants subject to guaranty, or if there are any deficiencies of the requirements of completion of the Work.

PART 2 - PRODUCTS

2.1 WATER

A. Water used in this work shall be suitable for irrigation and free from ingredients harmful to plant life.

B. Hose and other watering equipment required for the Work shall be furnished by the Contractor.

2.2 TOPSOIL

A. The Contractor shall furnish and place sufficient topsoil for the seeding and installation of sod.

2.3 FERTILIZER

A. Commercial fertilizer for lawn areas shall be complete fertilizer, formula 10-10-10, for lawns and shall conform to the applicable state fertilizer laws. Fertilizer shall be uniform in composition, dry and free flowing and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guarantee analysis. Any fertilizer which becomes caked or otherwise damaged making it unsuitable for use will not be accepted.

B. Fertilizer shall be applied at the rate of 25 pounds per 1,000 square feet.

2.4 GRASS SEED

A. The seed mixture to be sown shall be in the following proportions:

Common Name	Proportion By Weight	% of Purity	% of Germination
Fine Lawn Fescue	40	90	85
Chewings Fescue	25	90	85
Italian Rye Grass	20	90	85
Red Top	10	90	85
White Clover	5	95	90

B. All seed shall be fresh and clean and shall be delivered mixed, in unopened packages, bearing a guaranteed analysis of the seed mixture.

C. Germination must be certified to conform to the following minimums:

Purity	90%
Germination	85%

2.5 SOD

A. Sod shall be at least 70% Bluegrass, strongly rooted and free of pernicious weeds.

B. It shall be mowed to a height not to exceed 3" before lifting, and shall be of uniform thickness with not over 1-1/2" or less than 1" of soil.

2.6 MULCH

A. Mulch for seeded areas shall be Conwed Hydro Mulch, Silva-Fiber, or equal. It shall be suitable for use in a water slurry or for application with hydraulic equipment.

B. Clean straw is acceptable as mulch. It shall be spread at the rate of one (1) bale per 1,000 feet (approximately 2 inch loose depth).

C. Mulch on slopes greater than 1: 3 shall be held in place with erosion control netting.

D. Mulch on areas subject to surface water run-off or in drainage ditches shall be held in place with erosion control netting.

PART 3 - EXECUTION

3.1 TIME OF PLANTING

A. Planting operations shall be conducted under favorable weather conditions during seasons which are normal for such work as determined by accepted practice in the locality of the project. At the option and on full responsibility of the Contractor, planting operations may be conducted under unseasonable conditions without additional compensation.

3.2 LAWNS

A. Areas to be sodded are designated on the Drawings. All other lawn areas, including areas of cut and fill and where existing ground has been disturbed by construction operations shall be seeded.

B. Fertilizer:

1. Fertilizer shall be applied at the rate of 25 pounds per 1,000 square feet to the lawn area being prepared for planting and mixed lightly into the top few inches of topsoil. Fertilizer may be mixed with and distributed with grass seed.

C. Planting of Lawns:

1. Sowing of Seed:

a. Immediately before any seed is to be sown, the ground shall be scarified as necessary, and shall be raked until the surface is smooth, friable and of uniformly fine texture. Lawn areas shall be seeded evenly with a mechanical spreader at the rate of 4 pounds per 1,000 square feet of area, lightly raked, rolled with a 200-pound roller and watered with a fine spray. The method of seeding may be varied at the discretion of the Contractor on its own responsibility to establish a

smooth, uniform turf composed of the grasses specified. The sowing of seed shall be done only within the season extending from March 1st to May 15th and from September 1st to October 15th, unless other seasons may be approved by the Owner.

2. Laying of Sod:

   a. Before any sod is laid, all soft spots and inequalities in grade shall be corrected. Fertilizer spread shall be raked in. Sod shall be laid so that no voids occur, tamped or rolled and then thoroughly watered. The complete sodded surface shall be true to finished grade, even and firm at all points. Sodding shall be done only within the seasons extending from March 1st to May 15th and from September 1st to October 15th, unless other seasons may be approved by the Owner.

3. Sod on Slopes:

   a. Sod on slopes 2 to 1 or steeper shall be held in place by wooden pins about 1-inch square and about 6 inches long driven through the sod into the soil until they are flush with the top of the sod, or by other approved methods for holding the sod in place.

4. Mulching:

   a. All seeded areas are to be mulched with Conwed Hydro Mulch, Silva-Fiber, or equal, or with clean straw as specified under PRODUCTS. Mulch shall be applied at the rate of 1,500 pounds per acre. It may be applied with hydraulic equipment or may be added to the water slurry in a hydraulic seeder and the seeding and mulching combined in one operation. Clean straw may be spread by hand to cover the seeded areas at a depth of two (2) inches. Erosion control netting shall be installed and anchored per manufacturer's instructions in areas of slopes, ditches, or surface water runoff.

3.3 CLEAN UP

A. All soil, peat or similar material which has been brought over paved areas by hauling operations or otherwise, shall be removed promptly, keeping these areas clean at all times. Upon completion of the planting all excess soil, stone and debris which have not previously been cleaned up shall be removed from the site or disposed of as directed by the Owner. All lawns shall be prepared for final inspection.

3.4 OTHER WORK

A. The Contractor also shall be responsible for the repair of any damage caused by its activities or those of its subcontractors, such as the storage of topsoil or other materials, operations or equipment, or other usages to all on-site areas outside the contract limits. Such repair operations shall include any regrading, seeding or other work necessary to restore such areas to an acceptable condition.

3.5 QUALITY CONTROL

A. Areas seeded shall be protected until a uniform stand develops, when it will be accepted and the Contractor relieved of further responsibility for maintenance. Displaced mulch shall be replaced or any damage to the seeded area shall be repaired promptly, both in a manner to cause minimum disturbance to the existing stand of grass. If necessary to obtain a uniform stand, the Contractor shall refertilize, reseed and remulch as needed. Scattered bare spots up to one (1) square yard in size will be allowed up to a maximum of 10 percent of any area.

END OF SECTION 329200

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DIVISION 33

INSTRUMENTATION

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SECTION 330932 - BASIC MEASUREMENT AND CONTROL INSTRUMENTATION MATERIALS AND METHODS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall furnish all materials, labor, tools, equipment, supplies and services necessary to install all process control and instrumentation equipment complete as specified herein and shown on the Drawings. The Contractor shall be responsible for the expense of changing Drawings or structures, or any other expense necessitated by reason of installing alternative equipment. The Contractor will assume the responsibility for the satisfactory operation of any and all equipment offered.

B. The following equipment specification is included to establish the quality of equipment to be obtained. It is the intent of these Specifications to obtain industrial quality instrumentation and control equipment. Equipment furnished shall be accepted by the Engineer, prior to purchase by the Contractor.

C. Auxiliary and accessory devices necessary for system operation or performance, such as transducers or relays to interface with existing equipment or equipment provided under other Sections of this Specification, shall be included whether specified or not, at no extra cost.

D. In order to ensure proper integration and compatibility of the project instrumentation and control systems, the systems must be supplied by a single provider of instrumentation and control equipment. This is not to say that all equipment being supplied shall be manufactured by a single manufacturer, but rather that a single provider of instrumentation and control equipment shall be responsible for supplying the complete system. To facilitate the Owner's future operation and maintenance, products performing the same function shall all be of the same manufacturer, type, and model number.

E. Substitutions on functions or equipment specified will not be acceptable. In order to ensure the interchangeability of parts, the maintenance of quality, the ease of interfacing between the various subsystems, and the establishment of minimums with regard to ranges and accuracy, strict compliance with the above requirements shall be maintained. In order to ensure compatibility between all equipment, it shall be the responsibility of the system supplier hereunder to coordinate all interface requirements with mechanical and electrical system suppliers and furnish any signal isolation devices that might be required.

F. Equipment shall be fabricated, assembled, installed, and placed in proper operating condition in full conformity with detail drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer as accepted by the Engineer.

G. The instrument supplier for this Contract shall be responsible for making the modifications shown on the Drawings and for recalibrating all instruments (existing, where noted, and new) and placing them in proper working order.

1.2 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

SECTION 330933 –	Instruments
SECTION 330935 –	Existing SCADA Modifications
SECTION 330937 –	Instrument Lists and Reports
SECTION 330938 –	Measurement and Control Commissioning

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

DIVISION 01 –	General Requirements
DIVISION 11 –	Equipment
DIVISION 26 –	Electrical
DIVISION 46 –	Water and Wastewater Equipment

1.3 QUALITY ASSURANCE

A. The system supplier shall be prequalified as specified.

B. The system supplier shall have in its employ the capable personnel for detail engineering, coordination, drafting, procurement and expediting, scheduling construction, testing inspection, installation, programming, start-up service for calibration and commissioning, and warranty compliance for the period specified.

1.4 REFERENCES

A. The Contractor is referred to Standards and Practices for Instrumentation published by the International Society of Automation (latest edition), for terminology, symbols, methods and practices used or described herein or on the Drawings.

1.5 SUBMITTALS

A. General – Comply with requirements of Section 013323.

1. Complete detail Drawings of the instrumentation and control systems and all components shall be submitted in 3 copies in a 3-ring loose-leaf cardboard reinforced vinyl binder to the Engineer for review. They shall include installation instructions, operation and maintenance instructions, descriptive literature, connection drawings, and parts list for each item as well as individual control schematic drawings for each item.
2. The Contractor shall make any corrections or changes required by the Engineer, within the scope of the Drawings and Specifications, and return copies in 3-ring loose-leaf cardboard reinforced vinyl binders for final review and distribution. Number of copies

shall be as specified in Special conditions and as agreed at the pre-construction conference.

3. Should any system submitted in the shop drawings not meet with the Engineer's acceptance as to conformity with requirements of the Drawings and Specifications, it shall be the responsibility of the successful Contractor to make whatever changes are necessary for acceptance at no extra cost to the Owner.

B. Detailed Requirements - Instruments/Hardware

1. Detailed information for each instrument or control device shall be submitted, including manufacturer's descriptive literature and a specific data sheet for each device which shall include as a minimum:

    a. Tag number assigned by the manufacturer.
    b. Product (item) name used herein and on the Contract Drawings.
    c. Manufacturer's complete model number.
    d. Location of the device.
    e. Input - output characteristics.
    f. Range, size, and graduations.
    g. Physical size with dimensions, enclosure NEMA classification, and mounting details.
    h. Materials of construction of all components.
    i. Instrument or control device sizing calculations where applicable.
    j. Certified calibration data on all flow metering devices.

2. Submit a detailed loop diagram, for each monitoring or control loop, each on a single 8 ½ in. X 11 in. sheet. The format shall be the International Society of Automation, Standard for Instrument Loop Diagrams, ISA-S5.4.
3. The data sheets shall be provided with an index and proper identification and cross-referencing. Partial submittals will be rejected.
4. Submit detailed drawings concerning control panels and/or enclosures including:

    a. Cabinet assembly and layout drawings to scale.
    b. Fabrication and painting specifications.
    c. Point to point wiring diagrams depicting wiring within the panel as well as connections to external devices.
    d. Color samples for paint selection by the Engineer and/or Owner.

5. Exceptions to the Specifications or Drawings shall be clearly defined by the system supplier. Data shall contain sufficient details so a proper evaluation may be made by the Engineer.
6. Prior to final acceptance, the final shop drawing submittal, which is to include Installation, Operation, and Maintenance instructions, shall be updated to reflect "As Constructed" status, and shall provide at least the following as a minimum:

    a. A comprehensive index.
    b. A complete "As Constructed" set of accepted shop drawings.
    c. A complete list of the equipment supplied, including serial numbers, ranges, and pertinent data.
    d. Full specifications on each item.

e. System schematic drawings “As Constructed”, illustrating all components, piping and electrical connections of the systems supplied under this Section.
f. Detailed service, maintenance, and operation instructions for each item supplied.
g. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.
h. The operating instructions shall also incorporate a functional description of the entire system, with reference to the systems schematic drawings and instructions.
i. Complete parts lists with stock numbers and name, address, and telephone number of the local supplier.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Shipping Precautions:

1. After completion of shop assembly, factory test, and acceptance, all equipment, cabinets, panels, and consoles shall be packed in protective crates and enclosed in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing, and handling at the job site.
2. Special instructions for proper field handling, storage and installation required by manufacturer for proper protection, shall be securely attached to each piece of equipment proper to packaging and shipment.

B. Identification:

1. Each component shall be tagged to identify its location, tag number and function in the system. Identification shall be prominently displayed on the outside of the package.
2. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the tabulation, shall be provided on each piece of equipment supplied under this Section.

C. Storage:

1. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters including in-line equipment, and shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired by the Contractor at its own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the Engineer. This shall be at the cost and expense of the Contractor, or the apparatus shall be replaced by the Contractor at its own expense.

1.7 DEMOLITION

A. All existing instrumentation equipment presently installed in the existing Sodium Hypochlorite Building shall be abandoned and removed as shown on the Drawings. Unless otherwise noted, all removed instruments, materials and equipment shall be turned over to the Owner. In the

event removed equipment is not desired by the Owner, the Contractor shall remove equipment from the site.

1.8 WARRANTY (MAINTENANCE CONTRACT)

A. A written total instrument maintenance contract shall be provided to the Owner, executed by the system supplier as a part of the work under this Section. The maintenance contract shall include all labor, parts, and emergency calls providing on-site response within 48 hours, to provide complete instrument system maintenance for a period of one year after the date of final acceptance of the system. The maintenance contract shall also include a minimum of 2 semi-annual preventive maintenance visits by a qualified serviceman of the supplier who is familiar with the type of equipment provided for this project. Each preventive maintenance visit shall include routine adjustment, calibration, cleaning, and lubrication of all system equipment and verification of correct operations. Emergency maintenance procedures or plant visits may coincide with a scheduled preventive maintenance visit, however, they shall not replace the work intended to be performed during a preventive maintenance visit. The system supplier shall have full responsibility for the preventive and corrective maintenance including replacing of defective components, maintaining sufficient spare parts on-site, and complete calibration of all components under this section, all at no cost to the Owner. The maintenance contract shall not begin until both the instrumentation training course and the system acceptance test have been successfully completed, at which time the Owner shall be capable of performing necessary preventive maintenance, and all instruments shall be functional.

B. During the one-year maintenance period, observation of maintenance operations by designated Owner personnel, and the instruction of said personnel in the details of the maintenance work being performed shall be provided.

C. A complete written report shall be furnished the Engineer and Owner after each scheduled and unscheduled visit, giving problems corrected, systems needing recalibration, and recommendations to prevent recurrence, if applicable.

D. The costs for the one-year maintenance service contract shall be included in the Contract price.

1.9 TRAINING

A. A training program shall be set up and conducted by the major equipment manufacturer furnishing the instrumentation package. The training session shall be a minimum period of 1 day uninterrupted and shall be conducted at the treatment plant.

B. A course outline showing the material to be covered shall be submitted to the Engineer for review. The training program shall include both classroom and “hands-on” instruction for each instrument supplied under this group of the Specifications and shall furthermore include operational training, maintenance training, and training on use of calibration equipment.

C. As the equipment installed at the pump station shall be used for the “hands-on” training, the training program shall not be conducted until all of the systems are operational, and operational related “punch list” items are corrected.

D. Training on equipment supplied by a manufacturer other than the major equipment manufacturer shall be by the original equipment manufacturer, and shall be scheduled in the training programs by the major equipment manufacturer. Exceptions may be granted if the instructor demonstrates adequate knowledge on the care and operation of the other manufacturers' equipment.

E. The training programs shall be conducted at a time mutually agreeable to the Engineer, Owner, Contractor, and Supplier. The Owner shall decide how many of its personnel shall attend the training. A representative of the Engineer may observe the training in progress. The Owner shall have the right to record all training as it is conducted.

F. The supplier shall make use of audio-visual aids in the training courses and shall provide the Owners staff its undivided attention (i.e., shall not conduct its company business during training hours) for the entire day. The supplier shall furnish training participants with written handouts, preferably copies of the shop drawing submittal books, up to a maximum of 6 copies, for purposes of familiarization with the shop drawings, and to assist in explanations.

PART 2 - PRODUCTS

2.1 GENERAL

A. The bid shall be for furnishing instrumentation and control equipment of the brands listed in the specifications by a qualified supplier.

B. All instrumentation supplied shall be of the manufacturer's latest design and shall produce or be activated by signals which are established standards for the water industry.

C. All electronic instrumentation shall be of the solid-state type and shall utilize linear transmission signals of 4 to 20 mAdc (milliampere direct current), however, signals between instruments within the same panel or cabinet may be 0-10 V.d-c (volts direct current), or other manufacturer standard.

D. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero based signals will be allowed for remote transmission.

E. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks as shown on the Drawings or as required.

F. All indicators and LED readouts shall be linear, direct reading in process units, unless otherwise noted. Percentage scales and indicators are prohibited.

G. All transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to two percent, unless otherwise noted.

H. Electronic equipment shall be of the manufacturer's latest design, utilizing printed circuitry and suitably coated to prevent contamination by dust, moisture and fungus. Solid state components shall be conservatively rated for their purpose, to assure optimum long term performance and dependability over ambient atmosphere fluctuations and 0 to 95 percent relative humidity. The

field mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.

I. All equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, in-so-far as possible, and shall consist of equipment models which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.

J. All equipment shall be designed to operate on a 60 Hertz alternating current power source at a nominal 115 volts, plus or minus 10 percent, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

K. Materials and equipment used shall be UL listed (or other independent lab listed) wherever such listed equipment and materials are available.

L. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting when power is restored.

M. All circuit boards in instruments mounted in damp locations or mounted outdoors shall be fungus proofed. All field transmitters mounted outside shall be equipped with sunshades as specified in Section 330933.

N. All instruments shall be provided with surge suppression as noted on the Contract Drawings.

2.2 INSTRUMENTS AND ACCESSORY EQUIPMENT

A. Refer to other Division 33 Instrumentation Specification Sections for equipment requirements for field mounted primary devices, transmitters and secondary instruments, receivers and central control equipment.

PART 3 – EXECUTION (Not Applicable)

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END OF SECTION 330932

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SECTION 330933 - INSTRUMENTS

PART 1 – GENERAL

Per Addendum No. 1 *(4/27/15)*

Q8: *Specification section 330933 Instruments section 2.1 A 5c references a Gauge Schedule in specification section 330930.06. This schedule cannot be located. Please clarify.*

A8: *The correct specification reference to Gauge Schedule in 330933, Part 2.1.A.5.c should be 330937, Part 1.6.*

1.1 WORK INCLUDED

A. The Contractor shall furnish and install all primary devices, transmitters, primary and secondary receivers, analyzers and accessory items as shown on the Contract Drawings and as specified herein.

1.2 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

SECTION 330932 - Basic Measurement and Control Instrumentation Materials and Methods
SECTION 330934 - Boxes, Panels, and Control Centers
SECTION 330935 - Existing SCADA Modifications
SECTION 330937 - Instrument Lists and Reports
SECTION 330938 - Measurement and Control Commissioning

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

DIVISION 01 - General Requirements
DIVISION 11 - Equipment
DIVISION 26 - Electrical
DIVISION 46 - Water and Wastewater Equipment

PART 2 - PRODUCTS

2.1 INSTRUMENTS AND ACCESSORY EQUIPMENT

A. Product Descriptions

1. Loop Isolator/Signal Converter:

a. Loop isolators or signal converters shall be furnished and installed where indicated, to isolate signals or to increase the load capacity of a system required to have many devices in the loop. Isolators shall provide 3-way isolation, and shall have a power supply voltage of 115 VAC unless otherwise indicated. 2-wire style isolators are not acceptable. Isolators shall be Moore FCT-TX, AGM, RIS, or equal, enclosed as appropriate for the application, or as indicated.

2. Computing Relays/Integrators:

a. Computing relays or integrators for such purposes as amplitude discrimination, batching, summing, totalization, etc., shall be Moore, or equal.

3. Digital Displays

a. Digital displays of data shall be six digits: -9999 to 9999, 0.56" (14 mm) high, 7-segment, automatic lead zero blanking. Data shall be displayed in standard engineering units (i.e. psi, gpm, ft, etc). Display shall be 85-265 VAC 50/60 Hz, 20 watts maximum. Display shall be Precision Instruments PD603, or equal.
b. Digital display shall be provided with a minimum of one field selectable input: 0-20, 4-20 mA, +/-10VDC (0-5, 1-5, 0-10V). Display shall receive a 4-20mAdc continuous signal from Sodium Hypochlorite Storage Tank level transmitter to display tank level in feet.

4. Transient/Lightning Suppressors:

a. Lightning protectors shall be of 2 types - those for protecting d-c wires (current protectors) and those for protecting a-c wires.
b. The d-c protectors shall be of the fast-acting metal oxide varistor type (MOV) designed to fit and protect all typical 4-20 mA, field mounted transmitters from damaging transients induced by lightning or heavy electrical equipment, and shall provide protection each line to ground, and line-to-line.
c. The a-c protectors shall be the fast-acting MOV type in combination with a gas tube type secondary protector designed to provide protection against lightning and other high voltage surges for any a-c line-to-ground system.
d. The lightning protectors shall be installed at each end of each metering loop, and on all power supplies.
e. All PLC I/O shall be protected by TVSS devices either built-in the terminal strip or added to the panels.
f. Lightning and surge arrestors at field instruments shall be EDCO SLAC Series, or equal, for combination a-c and d-c signals.
g. Lightning and surge arrestors at field instruments shall be EDCO SS64 Series, or equal for 4-20 mAdc signals.

5. Pressure Gauges:

a. All indicating gauges in the Sodium Hypochlorite Room are pipe mounted with male and 316-stainless steel threaded pipe connections. Gauges shall be 4-1/2 inch liquid filled for maximum vibration and corrosion protection. Gauges shall have phosphor bronze Bourdon tubes (or other material compatible with stainless steel stem), white laminated phenol dials. Gauges shall have micrometer adjustment of pointers and black phenolic hermetically sealed case and ring, original rotary gear

design, corrosion resistant, stainless steel movement, blowout protection, and 316-stainless steel socket with wrench flats. Accuracy shall be within 1/2 of 1 percent of the scale range. They shall be Ashcroft, 1279 SS Duragage, or equal.

b. All gauges shall be piped with provisions for venting pressure to allow calibration (zero) checks. Valves for gauge shutoff and zeroing shall be ¼-turn ball valves with lever handle, corrosion-resistant. Ball valves upstream of diaphragm seals shall be 316-stainless steel while ball valves downstream of diaphragm seals shall be PVC. See Typical Pressure Gauge Piping Detail on Drawing I-501.

c. Liquid filled diaphragm seals shall be installed on all gauges as indicated in the Gauge Schedule in Section 330930.06 of the Specifications. Diaphragm seals shall be of the continuous duty type, 3-piece construction with ¼-inch flushing connection, ¼-inch fill connection, 316-stainless steel upper housing, PVC lower housing with Kalrez elastometer, ½-inch gauge connection and ½-inch lower connection. Housing bolts shall also be stainless steel. Acceptable models are Ashcroft Type 200 Series, or equal. Diaphragm seals shall be "permanently" attached to gauges by installation of a lead sealed wire connecting the two. This is to prevent accidental loss of fill fluid. Fill fluid shall be factory installed glycerine. All gauges shall be precalibrated, as an assembly with the seal.

6. Non-Contact Sonic Type

a. Where non-contact level measurement is indicated, the system shall consist of an integral sensor/transmitter assembly complete with housing, transmitter, microwave module and Wave-Guide (antenna). The radar assembly will transmit energy in the form of microwave pulses, target the microwave pulses returning to the antenna, measure the transit time of the microwave pulses and calculate the distance to the target. The radar assembly shall have the following features: integral level indicator and adjustment module for field calibration and display of process variable: 3"-10" ANSI 150# 316SS process connection with 316SS cone antenna 4-Wire Universal power supply (120VAC) with 4-20 mA HART output; programmable electronics shall provide linear 4-20mA output signal proportional to level or flow. The housing shall be a dual chamber aluminum style (minimum NEMA 4X).

b. Radar assemblies shall be 4-Wire with D-Housing for level and open channel flow measurement; PLICSCOM adjustment module for integral display and field calibration; use optional Waveguide Extension for applications that require a longer antenna length to protrude into the tank/channel.

c. Non-contact radar level measuring systems shall be Ohmart Vega PS66 series, or equal.

d. Where local field indicators are called out in the P&ID's they shall be two wire condulet style, DC milliameter with a range of 4-20 mAdc, thermally compensated, corrosion-resistant and weatherproof, for mounting on rigid conduit. The housing shall be aluminum with a glass viewing window, and connections shall be made through screw terminals. Accuracy shall be +/- 2 percent of full scale, with 0.1 percent repeatability. The indicators shall be linear, scaled in engineering units (not percent). Actual display may be analog or digital LCD.

e. Remote transmitters shall be located and mounted on the handrail as shown on the Contract Drawings.

7. In-Line Thermal Dispersion Flow Switch

a. Flow switches for chemical flow monitoring applications shall be in-line thermal dispersion type. The flow switch shall be low flow type with Titanium sensing element and 0.01 to 3 GPH flow range. Electronics shall be integral to the probe with LED indication through glass viewing area. Switch housing shall be cast aluminum A356, <0.2% copper.
b. Process connection shall be ½" with female NPT on both ends with orifice. The enclosures shall be NEMA 4X/IP67. The sensor shall operate in -100 to +400 degrees F conditions, and up to 2000 psig pressures.
c. Switch shall have non-linear mA output signal for trending, diagnostics, and flow level indication. Switch shall also be equipped with DPDT output relay rated 6 amps at 120VAC.
d. Switch shall be designed to operate at 115 VAC, 50-60Hz, 13 watts, 100mA maximum.
e. Switch shall be rigidly mounted to discharge side of chemical feed pump via Schedule 80 PVC. Provide pipe fitting to transition to chemical feed pump discharge piping as required. See C-series Drawings for process piping information.
f. Switch shall be Fluid Components International FTL93, or equal.

8. Vibrating Fork Level Limit Switch

a. The vibrating fork level switch shall be Endress+Hauser Liquiphant M FTL50/51.
b. The tuning fork shall vibrate at its resonant frequency until covered by fluid. When this occurs the resulting frequency shift activates a change of state of the unit's electronics.
c. Status indication – via dual LED's; power supply – 115 VAC, 60 Hz, with over voltage protection; output- AC/DC Relay.
d. Wetted parts – AlloyC4; body material – powder-coated NEMA4X aluminum housing with FM approval; process connection – MNPT or flanged as shown on the drawings; extension length as indicated on the drawings; where hazardous areas are indicated, the equipment shall be rated for that area.
e. Millimeter precision switch point; maximum fluid viscosity – 10000 cP; minimum fluid density – 0.5 g/cm3.
f. Options: Sliding sleeve for vertical adjustment of tuning fork as required.

9. Continuous pH Meter with Sensor and Transmitter

a. Transmitter

1) The transmitter shall be a microprocessor based instrument which can accept inputs from various sensors including the pH sensor specified herein.
2) The controller shall have the option for RS232/MODBUS® or RS485/MODBUS® serial input/output capability for two-way communication to a computer and have wireless downloading capability through an IR Port located on the interface unit to download and print realtime data, calibration history, and current set points in a CSV format.
3) The interface unit shall allow operators to control sensor and interface functions with menu-driven software.
4) The interface unit shall have two built-in data loggers with the capacity to store data on 15-minute intervals for up to 6 months with two sensors per controller.

5) The interface unit shall include two analog 4-20 mA outputs and 4 unpowered SPDT form 'C' alarm contacts.
6) The interface unit shall include two independent PID control functions.
7) The interface unit shall be housed in a NEMA-4X/IP66 metal enclosure with corrosion-resistant finish.
8) The controller shall be mounted horizontal or vertical on surface, panel or pipe.
9) The AC power supply shall be housed in the interface unit and automatically accept input in the range of 100 to 230 Vac, 50/60 Hz, switch selectable.
10) All system components shall be certified by ETL to UL 61010-1, CSA C22.2 No. 61010.1.
11) The controller shall be Hach model SC200 controller, or equal.

b. Sensor

1) The pH sensor shall be of differential electrode technique design which uses two electrodes to compare the process value to a stable reference standard buffer solution.
2) The standard electrode shall have non-flowing and fouling resistant characteristics.
3) The sensor shall have a hex shaped body to facilitate mounting, and shall be constructed of liquid crystal polymer for exceptional chemical resistance and mechanical strength.
4) The material shall enable the sensor to be installed in metal fittings without leakage usually caused by heating and cooling cycles when dissimilar materials are threaded together.
5) The sensor's built-in electronics shall be completely encapsulated to protect them from moisture and humidity.
6) The sensor shall have a built-in preamplifier to enable the signal to be transmitted up to 3000 ft. with standard cabling, or a built-in two-wire transmitter that provides a non-isolated 4-20 mADC output. The sensor shall be furnished with integral cable for connection to the transmitter.
7) The sensor signal shall be automatically temperature compensated by an integral temperature sensor.
8) The sensor shall include a metal ground electrode to eliminate ground loop currents in the measuring electrodes.
9) The sensor shall be GLI, or equal.
10) The pH sensor shall be flow-thru tee mounted in 3” PVC piping as shown on Contract Drawings.

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 330933

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SECTION 330934 - BOXES, PANELS AND CONTROL CENTERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall furnish and install all boxes, panels and control centers and accessory items as shown on the Contract Drawings and as specified herein.

B. Prior to the delivery and installation of the project control panels (all control panels required as part of the project) at the job site, but after the procurement, assembly, and configuration of all components, the Contractor shall conduct a factory test. This test shall be witnessed by representatives of the Owner and the Engineer. The factory test shall demonstrate the functionality and performance of specified features of the control panels. A complete system checklist shall be available during the test for recording point test results. The Contractor shall schedule the factory test and shall provide the Owner and Engineer with written notice of the start and expected duration of the factory test at least 14 days prior to the start of the test. The Contractor shall record the results of all factory testing on preapproved test forms which the Owner's and Engineer's representatives shall sign. A copy of the completed test forms and a report certifying the results shall be provided to the Engineer within 10 days of completing the test.

1.2 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

SECTION 330932 – Basic Measurement and Control Instrumentation Materials and Methods
SECTION 330933 – Instruments
SECTION 330935 – Existing SCADA Modifications
SECTION 330937 – Instrument Lists and Reports
SECTION 330938 – Measurement and Control Commissioning

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

DIVISION 01 – General Requirements
DIVISION 11 – Equipment
DIVISION 26 – Electrical
DIVISION 46 – Water and Wastewater Equipment

1.3 SUBMITTALS

A. Comply with the requirements of Section 013323.

PART 2 - PRODUCTS

2.1 FABRICATION

A. Instrument Panels

1. Furnish and install the following instrument panels:

   a. Truck Fill Station
   b. Sodium Hypochlorite High Level Alarm Control Panel
   c. Chemical Metering Pump Control Panel

2. The instrument panels shall be similar in design to that shown on the Drawings or as specified herein. The panel shall be of fiberglass construction. Panel shall be suitable for surface wall mounting.
3. All conductors running from the field to the panel shall be a single, continuous length, without splices, except at accepted junction boxes. The junction boxes shall have terminal blocks with 20 percent spares in addition to terminals for all wires including spare wires. Special care shall be exercised to carry grounding lines through such junction boxes with the least possible resistance.
4. All panel equipment shall be mounted and wired on or within the cabinet. Wiring shall comply with the latest National Electrical Code. All wiring within the panel shall be grouped together with harnesses or ducts and secured to the structure. All wiring shall be numbered in accordance with the numbering system used on the wiring/connection diagrams. Wiring and connection diagrams shall conform to ISA S5.4 Instrument Loop Diagrams and shall be submitted by the manufacturer as part of the shop drawings for review. Power and low voltage d-c signal wiring shall be routed in separate wireways. Crossing of the 2 system wires shall be at right angles. Parallel troughs of different systems shall be separated by a minimum of 12 inches. Power wire shall be 16 AWG type THWN stranded, insulated for not less than 600 volts, unless specified otherwise. Wire color shall be Line Power - Black; Neutral or common - White; AC Control - Red; DC Control - Blue; Equipment or Chassis Ground - Green; specified externally powered circuits - Yellow.
5. All wiring shall terminate in a master terminal board, rigid type and numbered. The master terminal board shall have a minimum of 25 percent spares. Terminal blocks shall be arranged in vertical rows and separated into groups (Power, AC control, DC signal, alarm). Terminal blocks shall be barrier type with the appropriate voltage rating (600 volts minimum). They shall be the raised channel mounted type. Wiring trough for supporting internal wiring shall be plastic type with snap-on covers. The side walls shall be open top type to permit wire changing without disconnecting. Wire connectors shall be the hook fork type with non-insulated barrel for crimp type compression connection to the wire. Wire and tube markers shall be the sleeve type with heat impressed letters and numbers, Grafoplast or Brady. Terminal strips shall be provided for the purpose of connecting all control and signal wiring. Direct interlock wiring between equipment will not be allowed. Only one side of a terminal block row shall be used for internal wiring. The field wiring side of the terminal shall not be within 6 inches of the side panel or adjacent terminal. Wiring troughs shall not be filled to more than 60 percent visible fill. Wiring trough covers shall be match marked to identify placement. If component

identification is shown on covers for visibility, the ID shall also appear on the mounting sub-panel.

6. Nameplates shall be provided for all flush mounted equipment. The nameplates shall be approximately 1 inch by 3 inch constructed of black and white laminated, phenolic material having engraved letters approximately 1/4 inch high, extending through the white face into the black layer. Nameplates may be omitted if a nameplate of approximately the same dimension is more conveniently and suitably located on the instrument door or face. Nameplates shall be attached to panels by self tapping screws.
7. Print storage pockets shall be provided on the inside of each panel. Its size shall be sufficient to hold all of the prints required to service the equipment.
8. The instrument panel shall be factory-tested prior to shipment. Field installation by the Subcontractor shall consist only of setting the panel in place and making necessary electrical connections.
9. All components shall be mounted in a manner that shall permit servicing. adjustment, testing and removal without disconnecting, moving or removing any other component. All displays, programming keypads, switches, pushbuttons and accessories shall be flush mounted.
10. Components mounted on the inside of panels shall be mounted on removable plates and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required otherwise by the manufacturer to protect equipment from vibration. Component mounting shall be oriented in accordance with the component manufacturer's and industries' standard practices. All internal components shall be identified with suitable plastic or metal engraved tags attached with drive pins adjacent to (not on) each component identifying the component in accordance with Drawings, Specifications, and Supplier's data.
11. Pushbuttons shall be heavy-duty, oil tight, with momentary contacts. Switches shall be supplied with the number of poles required for the application, an escutcheon plate, and contacts rated for 10 amperes at 120 volts a-c.
12. Relays shall be Allen Bradley, Potter and Brumfield, or equal.
13. Timers shall be plug-in type with a dust and moisture resistant case. The timers shall be of the multi-range/analog or digital type with selectable ranges, between 1 second and 10 hours full scale. The output contacts shall be rated at 2.5 amperes 120 volt a-c minimum. The timer shall have a "timing in progress" indication. The mechanical life shall be 10,000,000 operations minimum.
14. Selector switches shall be of a type similar to those specified for motor control in Division 26.
15. General layout of instruments and controls are shown on the Contract Drawings. Minor deviations from the layout may be allowed after review by the Engineer.
16. The instrument panel shall be furnished by the instrumentation and control system supplier. Complete shop drawings, including wiring diagrams and panel structural drawings, shall be required for review prior to shipment.
17. Loop isolators called out or intrinsic safety barriers shall mount inside the instrument panels.
18. **Panel construction and component selection shall comply with Specification Section 262716 – Control Panels and Enclosures.**

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 330934

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SECTION 330935 – EXISTING SCADA MODIFICATIONS

PART 1 - GENERAL

Per Addendum No. 1 *(4/27/15)* *SCADA HMI Programming – All references in the Contract Specifications related to SCADA HMI programming shall be accomplished by the Northern Kentucky Water District.*

1.1 WORK INCLUDED

A. SCADA System Description of Work

1. Northern Kentucky Water District operates three water treatment plants: Taylor Mill Water Treatment Plant, Fort Thomas Water Treatment Plant, and Memorial Parkway Water Treatment Plant. The SCADA System at each water treatment plant utilizes Wonderware v10 HMI software. The SCADA System HMI software at each Plant shall be updated to include new work associated with the new Dudley Pump Station Sodium Hypochlorite Building. New graphics screens shall be created as noted within these Specifications.

2. There are (2) existing RTU's located at the Dudley Pump Station: one at the 1040 Pump Station Building and one at the 1080 Pump Station Building. Each RTU has an Allen-Bradley 1756 10-slot chassis with ControlLogix 1756-L55M13 PLC's. Each RTU communicates with the Taylor Mill Water Treatment Plant via GE MDS9710 fixed frequency radios. The Dudley 1040 PLC chassis shall be modified as noted below, and as shown on the Contract Drawings. No work is required at the Dudley 1080 PLC.

3. The Dudley 1040 Pump Station RTU PLC shall be modified to accept new analog and digital inputs/outputs as noted on the I-Series Contract Drawings. The following I/O modules shall be furnished and installed:

   a. 1756-IF8 – Analog Input Module
   b. 1756-OF8 – Analog Output Module
   c. (2) 1756-IB16 – Digital Input Modules

4. The existing Plant SCADA HMI graphic screens (at each of the water treatment plants noted above) shall be modified to reflect process changes described herein and indicated on Contract Drawings. Indicators, adjustable setpoints, etc. shall be reconfigured as required. The Contractor shall include all programming costs for modifying these graphics screens in bid. The graphics screens shall be as determined in project meetings with the Owner. Attached to this Specification are two screen shots of the Plant HMI graphics screens associated with the existing Sodium Hypochlorite system used at the Dudley Pump Station. The Contractor shall modify the existing Plant HMI graphics screens as noted:

   a. Dudley1040_Barrington_Kenton Screen:
      i) Remove existing controls pertaining to the Sodium Hypochlorite system, including Sod Hypo Storage Tank, Sod Hypo Daytank #2, Chemical Feed Pump, Transfer Pumps, speed control, Cl2 Dosage, and Enable Setpoint.
      ii) Create a new pop-up window for the complete new Sodium Hypochlorite System, as described in Specification Section 330937 and the Contract Drawings. Provide a new link at the Dudley1040_Barrington_Kenton Screen to access the new

Sodium Hypochlorite system window.

b. Dudley1080_Industrial_Devon Screen:

i) Remove existing controls pertaining to the Sodium Hypochlorite system, including Sod Hypo Daytank #1, Chemical Feed Pump, Transfer Pumps, Cl2 Dosage and Enable Setpoint.

ii) Create a new pop-up window for the complete new Sodium Hypochlorite System, as described in Specification Section 330937 and the Contract Drawings. Provide a new link at the Dudley1080_Industrial_Devon Screen to access the new Sodium Hypochlorite system window.

5. New graphics screens shall be created for the new Sodium Hypochlorite process in a new pop-up window as described above. The graphics screens shall be as determined in project meetings with the Owner. The attached screen shots from the existing Plant HMI will provide the Contractor with an idea of the detail of graphics screens desired by the Owner.

6. The new process alarms, as noted on the Contract Drawings, shall be incorporated into the existing Plant SCADA HMI at each water treatment plant.

1.2 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section:

SECTION 330932 – Basic Measurement and Control Instrumentation Materials and Methods
SECTION 330933 – Instruments
SECTION 330937 – Instrument Lists and Reports
SECTION 330938 – Measurement and Control Commissioning

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

DIVISION 01 - General Requirements
DIVISION 11 - Equipment
DIVISION 26 - Electrical
DIVISION 46 - Water and Wastewater Equipment

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 330937 - INSTRUMENT LISTS AND REPORTS

PART 1 - GENERAL

Per Addendum No. 1 *(4/27/15)* *SCADA HMI Programming – All references in the Contract Specifications related to SCADA HMI programming shall be accomplished by the Northern Kentucky Water District.*

1.1 WORK INCLUDED

A. The Contractor shall furnish and install all instrumentation equipment and accessory items as shown on the Contract Drawings and as specified herein.

1.2 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

SECTION 330932 – Basic Measurement and Control Instrumentation Materials and Methods
SECTION 330933 – Instruments
SECTION 330935 – Existing SCADA Modifications
SECTION 330938 – Measurement and Control Commissioning

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

DIVISION 01 – General Requirements
DIVISION 11 – Equipment
DIVISION 26 – Electrical
DIVISION 46 – Water and Wastewater Equipment

1.3 SUBMITTALS

A. Comply with the requirements in Section 013323.

1.4 INPUT/OUTPUT POINT LIST

A. See the I/O listing shown on the Contract Drawings I-801 and I-802. New I/O is indicated in bold (heavy) pen; existing I/O is indicated in shaded pen.

1.5 P&ID – CONTROL STRATEGIES/SEQUENCES

A. Process Equipment Tagging

ST-1 – Sodium Hypochlorite Storage Tank, 3000 gallon
T-1040 – Daytank 1040, 200 gallon (daytank utilized for chemical metering to the Dudley 1040 Booster Pumps)
T-1080 – Daytank 1080, 200 gallon (daytank utilized for chemical metering to the Dudley 1080 Booster Pumps)
TP-1040 – Transfer Pump 1040 (pumping from ST-1 to T-1040)
TP-1080 – Transfer Pump 1080 (pumping from ST-1 to T-1080)
FSL-101 – In-Line Flow Switch @ TP-1040 Discharge
FSL-102 – In-Line Flow Switch @ TP-1080 Discharge
CMP-1 – Chemical Metering Pump 1 (pumping from T-1040 to Dudley 1040 Booster Pumps)
CMP-2 – Chemical Metering Pump 2 (pumping from T-1040 to Dudley 1040 Booster Pumps)
CMP-3 – Chemical Metering Pump 3 (pumping from T-1080 to Dudley 1080 Booster Pumps)
CMP-4 – Chemical Metering Pump 4 (pumping from T-1080 to Dudley 1080 Booster Pumps)
FSL-103 – In-Line Flow Switch @ CMP-1/2 Common Discharge
FSL-104 – In-Line Flow Switch @ CMP-3/4 Common Discharge
PI-101 – Pressure Gauge @ CMP-1/2 Common Discharge
PI-102 – Pressure Gauge @ CMP-3/4 Common Discharge
FSH-101 – High Level Flow Switch @ Emergency Eyewash/Shower
AIT-101 – pH Transmitter @ ST-1
LIT-101 – Level Transmitter @ ST-1
LSH-101 – Vibration Fork High Level Switch Alarm @ ST-1
LIT-102 – Level Transmitter @ T-1040
LSH-102 – Vibration Fork High Level Switch Alarm @ T-1040
LIT-103 – Level Transmitter @ T-1080
LSH-103 – Vibration Fork High Level Switch Alarm @ T-1080

B. Emergency Eyewash/Shower

The emergency eyewash/shower shall be provided with a local flow switch and alarm system. Flow switch shall be furnished with the emergency eyewash/shower. The Plant SCADA HMI software shall allow operator interface for monitoring activation of the flow switch. A digital input shall be provided from the flow switch to the existing Dudley 1040 PLC. Provide graphical indication of emergency eyewash/shower alarm in the Plant SCADA HMI workstation at the Taylor Mill WTP, Fort Thomas WTP, and Memorial Parkway WTP.

C. Containment Sump

A new vibration fork level sensor, LSH-101, shall be provided in the containment sump, mounted 12" below the containment sump grating. The Plant SCADA HMI software shall allow operator interface for monitoring high level in the containment sump. A digital input shall be provided from the Sodium Hypochlorite High Level Alarm Control Panel to the existing Dudley 1040 PLC. Provide graphical indication of containment sump high level alarm in the Plant SCADA HMI workstation at the Taylor Mill WTP, Fort Thomas WTP, and Memorial Parkway WTP.

Elevation: 10" AFF (12" below top grating)

D. Transfer Pumps

Two transfer pumps, TP-1040 and TP-1080, shall be provided to transfer NaOCl from ST-1 to T-1040 and T-1080. A local Transfer Pump Control Panel shall be provided adjacent to the transfer pumps. The Transfer Pump Control Panel shall be provided with a HAND-OFF-AUTO selector switch for each transfer pump. In the HAND position the selected transfer pump shall run continuously until the respective daytank high level is reached or the switch is placed in the OFF position. In the OFF position the selected transfer pump shall remain de-energized.

In the AUTO position the transfer pumps shall be controlled via the existing Dudley 1040 PLC based on daytank T-1040 or T-1080 level. The existing Dudley 1040 PLC shall provide a digital start/stop signal to the Transfer Pump Control Panel for automatic control of transfer pump TP-1040 or TP-1080.

a. The existing Dudley 1040 PLC shall automatically start TP-1040 when the T-1040 level falls below 0'-8". Once the T-1040 level reaches 4'-6" the Dudley 1040 PLC shall automatically stop TP-1040.
b. The existing Dudley 1040 PLC shall automatically start TP-1080 when the T-1080 level falls below 0'-8". Once the T-1080 level reaches 4'-6" the Dudley 1040 PLC shall automatically stop TP-1080.

Hardwired Interlocks:

a. Transfer Pump TP-1040 – Pump shall automatically de-energize upon daytank T-1040 high level as measured via LSH-102 (vibration fork level switch).
b. Transfer Pump TP-1040 – Pump shall automatically de-energize upon containment sump high level as measured via LSH-101 (vibration fork level switch).
c. Transfer Pump TP-1080 – Pump shall automatically de-energize upon daytank T-1080 high level as measured via LSH-103 (vibration fork level switch).
d. Transfer Pump TP-1080 – Pump shall automatically de-energize upon containment sump high level as measured via LSH-101 (vibration fork level switch).

The Transfer Pump Control Panel shall provide digital outputs to the existing Dudley 1040 PLC to monitor the following:

a. Transfer Pump 1040 Run Status
b. Transfer Pump 1080 Run Status
c. Transfer Pumps Locked Out
d. Transfer Pump 1040 Motor Overload
e. Transfer Pump 1080 Motor Overload

Provide graphical indication of status and alarms, as well as record running time of each transfer pump, in the Plant SCADA HMI workstation at the Taylor Mill WTP, Fort Thomas WTP, and Memorial Parkway WTP.

E. Chemical Metering Pumps, CMP-1 and CMP-2 (feed to Dudley 1040 Booster Pumps)

Two chemical metering pumps, CMP-1 and CMP-2, shall be provided to feed NaOCl from T-1040 to the Dudley 1040 Booster Pumps. A local Chemical Metering Pump Control Panel shall be provided and located at the upper level of the Sodium Hypochlorite Building, adjacent to the storage tank/daytank level transmitters. The Chemical Metering Pump Control Panel shall be provided with a HAND-OFF-AUTO selector switch for each chemical metering pump. In the HAND position the selected chemical metering pumps shall run continuously until switched to

the OFF position. A local process controller is provided to enable local manual speed control and speed feedback of each chemical metering pump.

In the OFF position the selected chemical metering pump shall remain de-energized.

In the AUTO position the chemical metering pumps shall be controlled via the existing Dudley 1040 PLC and paced via the Dudley 1040 PS chlorine residual setpoint. The existing Dudley 1040 PLC shall provide a digital start/stop signal to the Chemical Metering Pump Control Panel at any time any of the existing Booster Pumps No.1 through No.4 are energized. The Plant SCADA HMI shall be provided with an operator adjustable setpoint for chlorine residual setpoint for pacing the respective chemical metering pump. Chemical metering pumps CMP-1 and CMP-2 shall not operate simultaneously – alternation of pumps will be manual by Operator. The respective chemical metering pump shall be de-energized whenever all the existing Booster Pumps No.1 through No.4 are de-energized.

Automatic speed control of each chemical metering pump shall be via the existing Dudley 1040 PLC. A 4-20mAdc continuous signal shall be provided from the Dudley 1040 PLC to the Chemical Metering Pump Control Panel for speed control of each chemical metering pump. A 4-20mAdc continuous signal shall be provided from the respective chemical metering pump SCADA Module to the existing Dudley 1040 PLC for speed feedback of each pump.

Digital monitoring signals shall be provided from the Chemical Metering Pump Control Panel to the existing Dudley 1040 PLC. Provide graphical indication of pump run status, In Auto position (controls), In Auto position (pump), and leak detected, as well as record running time of each chemical metering pump, in the Plant SCADA HMI workstation at the Taylor Mill WTP, Fort Thomas WTP, and the Memorial Parkway WTP.

Software Interlocks:

a. Chemical Metering Pump CMP-1 – Pump shall automatically de-energize upon daytank T-1040 low level as measured via LIT-102. Low level lockout shall be 0’-6”.
b. Chemical Metering Pump CMP-2 – Pump shall automatically de-energize upon daytank T-1040 low level as measured via LIT-102. Low level lockout shall be 0’-6”.

Cl2 Dosing Rate: 1.5 mg/L (to be determined during startup)

F. Chemical Metering Pumps, CMP-3 and CMP-4 (feed to Dudley 1080 Booster Pumps)

Two chemical metering pumps, CMP-3 and CMP-4, shall be provided to feed NaOCl from T-1080 to the Dudley 1080 Booster Pumps. A local Chemical Metering Pump Control Panel shall be provided and located at the upper level of the Sodium Hypochlorite Building, adjacent to the storage tank/daytank level transmitters. The Chemical Metering Pump Control Panel shall be provided with a HAND-OFF-AUTO selector switch for each chemical metering pump. In the HAND position the selected chemical metering pumps shall run continuously until switched to the OFF position. A local process controller is provided to enable local manual speed control and speed feedback of each chemical metering pump.

In the OFF position the selected chemical metering pump shall remain de-energized.

In the AUTO position the chemical metering pumps shall be controlled via the existing Dudley 1040 PLC and paced via the Dudley 1080 PS chlorine residual setpoint. The existing Dudley 1040 PLC shall provide a digital start/stop signal to the Chemical Metering Pump Control Panel

at any time any of the existing Booster Pumps No.5 through No.8 are energized. The Plant SCADA HMI shall be provided with an operator adjustable setpoint for chlorine residual setpoint for pacing the respective chemical metering pump. Chemical metering pumps CMP-3 and CMP-4 shall not operate simultaneously – alternation of the pumps will be manual by Operator. The respective chemical metering pump shall be de-energized whenever all the existing Booster Pumps No.5 through No.8 are de-energized.

Automatic speed control of each chemical metering pump shall be via the existing Dudley 1040 PLC. A 4-20mAdc continuous signal shall be provided from the Dudley 1040 PLC to the Chemical Metering Pump Control Panel for speed control of each chemical metering pump. A 4-20mAdc continuous signal shall be provided from the respective chemical metering pump SCADA Module to the existing Dudley 1040 PLC for speed feedback of each pump.

Digital monitoring signals shall be provided from the Chemical Metering Pump Control Panel to the existing Dudley 1040 PLC. Provide graphical indication of pump run status, In Auto position (controls), In Auto position (pump), and leak detected, as well as record running time of each chemical metering pump, in the Plant SCADA HMI workstation at the Taylor Mill WTP, Fort Thomas WTP, and the Memorial Parkway WTP.

Software Interlocks:

a. Chemical Metering Pump CMP-3 – Pump shall automatically de-energize upon daytank T-1080 low level as measured via LIT-103. Low level lockout shall be 0'-6".
b. Chemical Metering Pump CMP-4 – Pump shall automatically de-energize upon daytank T-1080 low level as measured via LIT-103. Low level lockout shall be 0'-6".

Cl2 Dosing Rate: 1.5 mg/L (to be determined during startup)

G. NaOCl Storage Tank

The level in the Sodium Hypochlorite Bulk Storage Tank shall be measured via new non-contact radar (flange mounted) level transducer/transmitter. The transmitter shall be handrail-mounted adjacent to the entry door to the Sodium Hypochlorite Building. The local transmitter shall produce a continuous 4-20mAdc signal linear with level, looped through a loop isolator. One dedicated 4-20mAdc continuous signal shall be output to the existing Dudley 1040 PLC for level monitoring. One dedicated 4-20mAdc continuous signal shall be output to the Bulk Tank High Level Status Control Panel for local tank level indication via new level display. The measured level signal shall be displayed and recorded in the Plant SCADA HMI software at the Taylor Mill WTP, Fort Thomas WTP, and Memorial Parkway WTP. Provide low level alarm and high level alarm, with operator interface of each in the Plant SCADA HMI for alarm setpoint adjustments.

A vibrating fork level limit switch shall be provided for redundant high level alarm at the Sodium Hypochlorite Bulk Storage Tank. A contact output shall be provided from the level switch to the Sodium Hypochlorite High Level Alarm Control Panel to alarm operator that the bulk storage tank is full. A contact output shall be provided from the Sodium Hypochlorite High Level Alarm Control Panel to the existing Dudley 1040 PLC for monitoring the bulk storage tank high level alarm. Provide graphical indication of the bulk storage tank high level alarm in the Plant SCADA HMI workstation at the Taylor Mill WTP, Fort Thomas WTP, and Memorial Parkway WTP.

A pH probe/transmitter shall be provided at the Sodium Hypochlorite Bulk Storage Tank to continuously monitor pH level. The pH probe shall be installed at the tank discharge piping (prior to transfer pumps) via an in-line pipe tee for pH flow-through monitoring. The transmitter shall be handrail-mounted adjacent to the entry door to the Sodium Hypochlorite Building. The local transmitter shall produce a continuous 4-20mAdc signal output to the existing Dudley 1040 PLC. The measured pH signal shall be displayed and recorded in the Plant SCADA HMI software at the Taylor Mill WTP, Fort Thomas WTP, and Memorial Parkway WTP. Provide low level alarm, with operator interface in the Plant SCADA HMI for alarm setpoint adjustments.

The following calibration ranges shall be provided:

Bulk Storage Tank Level Range: 0 – 10'-6".
Bulk Storage Tank Low Level (via radar transmitter): 12"
Bulk Storage Tank High Level (via radar transmitter): 10'-0".
Bulk Storage Tank High Level Elevation (vibrating fork): 10'-2".
Bulk Storage Tank pH Level: 0 – 14 pH

H. NaOCl Daytanks

The level in each Sodium Hypochlorite Daytank, T-1040 and T-1080, shall be measured via new non-contact radar (flange mounted) level transducers/transmitters. The transmitters shall be handrail-mounted adjacent to the entry door to the Sodium Hypochlorite Building. The local transmitters shall produce a continuous 4-20mAdc signal output to the existing Dudley 1040 PLC. The measured level signals shall be displayed and recorded in the Plant SCADA HMI software at the Taylor Mill WTP, Fort Thomas WTP, and Memorial Parkway WTP. Provide low level alarm and high level alarm, with operator interface of each in the Plant SCADA HMI for alarm setpoint adjustments for each daytank.

A vibrating fork level limit switch shall be provided for redundant high level alarm at each Sodium Hypochlorite Daytank, T-1040 and T-1080. A contact output shall be provided from each level switch to the Sodium Hypochlorite High Level Alarm Control Panel to alarm operator that the respective daytank is full. A contact output shall be provided from the Sodium Hypochlorite High Level Alarm Control Panel to the existing Dudley 1040 PLC for monitoring each daytank high level alarm. Provide graphical indication of each daytank high level alarm in the Plant SCADA HMI workstation at the Taylor Mill WTP, Fort Thomas WTP, and Memorial Parkway WTP.

The following calibration ranges shall be provided:

Daytank T-1040 Level Range: 0 – 5'-6"
Daytank T-1040 Low Level (via radar transmitter): 0'-6"
Daytank T-1040 High Level (via radar transmitter): 5'-0"
Daytank T-1040 High Level Elevation (vibrating fork): 5'-2"
Daytank T-1080 Level Range: 0 – 5'-6"
Daytank T-1080 Low Level (via radar transmitter): 0'-6"
Daytank T-1080 High Level (via radar transmitter): 5'-0"
Daytank T-1080 High Level Elevation (vibrating fork): 5'-2"

I. In-Line Flow Dispersion Switch

In-line flow dispersion switches shall be provided at the discharge of each transfer pump, as well as the common discharge of chemical metering pumps CMP-1/2 and CMP-3/4. A contact output shall be provided from each flow switch to the existing Dudley 1040 PLC for monitoring a 'no flow' condition. Provide graphical indication of each 'no flow' alarm in the Plant SCADA HMI workstation at the Taylor Mill WTP, Fort Thomas WTP, and Memorial Parkway WTP.

1.6 GAUGE SCHEDULE

Location	**Size**	**Range PSI**	**Accessories**	**No. Required**
Chemical Metering Train 1040 Discharge	4-1/2"	0-30	A,B,C,D,E	1
Chemical Metering Train 1080 Discharge	4-1/2"	0-30	A,B,C,D,E	1

Pressure Gauge Accessory Code:

A – Gauge Liquid Filled

B – Ball Valves for Shutoff and Vent

C – Diaphragm Seal (316 Stainless Steel Upper Housing, PVC Lower Housing, Kalrez Elastomer)

D – Stainless Steel Gauge

E – Gauge Side of Diaphragm Seal - Stainless Steel Ball Valves and Piping
Tap Side of Diaphragm Seal – PVC Ball Valves and Piping

PART 2 – PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 330937

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SECTION 330938 - MEASUREMENT AND CONTROL COMMISSIONING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall furnish and install all instrumentation equipment and accessory items as shown on the Contract Drawings and as specified herein.

1.2 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section:

SECTION 330932 – Basic Measurement and Control Instrumentation Materials and Methods
SECTION 330933 – Instruments
SECTION 330935 – Existing SCADA Modifications
SECTION 330937 – Instrument Lists and Reports

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

DIVISION 01 – General Requirements
DIVISION 11 – Equipment
DIVISION 26 – Electrical
DIVISION 46 – Water and Wastewater Equipment

PART 2 – PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/ERECTION

A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters, alarms and similar devices shown on the Drawings are approximate only. Exact locations shall be as accepted by the Engineer during construction. Obtain in the field all information relevant to the placing of process control work, proceed as directed by the manufacturer and furnish all labor and materials necessary to complete the work in an acceptable manner.

B. The instrumentation installation details on the Drawings indicate the designed installation for the instruments specified. Where specific installation details are not specified or shown on the Drawings, the manufacturer's recommended practice shall be followed.

C. All work shall be executed in full accordance with codes. Should any work be performed contrary to said codes and/or regulations, the Contractor shall bear full responsibility for such violations and assume all costs arising there from. All equipment used in areas designated as hazardous shall be designed for the Class, Division, and Group as required on the Drawings for the locations.

D. Unless specifically shown in the Contract Documents, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument racks or stands. All instrumentation connections shall be provided with shutoff and drain valves.

E. All piping to and from field instrumentation shall be provided with necessary unions, test tees, couplings, adaptors, and shut-off valves.

F. Field instruments requiring power supplies shall be provided with local electrical shut-offs and fuses as required.

G. Brackets and hangers required for mounting of equipment shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment.

H. The system supplier shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, the system supplier shall be required to ship its material in sections sized to permit passing through restricted areas in the building. The system supplier shall also investigate, and make any field modifications to the allocated space for each cabinet, enclosure and panel to assure proper space and access (front, rear, side).

I. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded as directed by the manufacturer of the instrumentation equipment but in no case shall more than one ground point be employed for each shield.

J. Lifting rings shall be removed from cabinets/assemblies. Hole plugs shall be provided for the holes of the same color as the cabinet.

K. The system supplier, acting through the Contractor, shall coordinate the installation, the placing and location of system components, their connections to the process equipment panels, cabinets and devices, subject to the Engineer's acceptance. It shall be responsible to ensure that all field wiring for power and signal circuits are correctly done in accordance with best industry practice and provide for all necessary system grounding to ensure a satisfactory functioning installation. The Contractor hereunder shall schedule and coordinate its work under this Section with that of the electrical work specified under applicable Sections of Division 16.

3.2 FIELD QUALITY CONTROL

A. After equipment and materials have been shipped to the job site, the Supplier shall furnish the services of a factory-trained service technician or engineer to assist and advise the Contractor during installation and to provide programming/calibration/adjustment at initial startup. A minimum period

of 5 calendar days on the job site is required, and expenses associated with additional days necessary shall be at no cost to the Owner.

B. Following installation, checkout, and final adjustment of all panels, instruments, meters, monitoring, and control devices, the Contractor shall schedule a performance test in the presence of the Engineer on all equipment. The Contractor shall furnish the services of the system supplier's servicemen, all special tools, calibration equipment, and labor to perform the tests.

C. Meters shall be tested at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of scale, if possible. All status and alarm switches as well as all monitoring and control functions shall also be checked, including logging at printers and change of state on graphics. Testing shall be done from the signal source to the final element or device including all field wiring. Results of all testing shall be submitted to the Engineer in writing.

D. As much as possible, points shall be checked "end-to-end". For example, valve status inputs shall be checked by stroking the valve, and a pump start output shall be checked by using it to start the pump. Simulated testing shall be allowed only when no practical alternative exists. Workstation displays shall be verified for correctness at the same time. An I/O checklist shall be used to record test results and a copy provided to the Engineer upon completion. During system testing, the Contractor shall have a representative onsite continuously who is capable of troubleshooting and modifying SCADA system configuration programming.

E. If, during running of the tests, one or more points appear to be out by more than the system accuracy statement, or fails to perform in accordance with agreed strategies, the system supplier's servicemen shall make such adjustment or alterations as are necessary to bring equipment/programming up to specification performance. Following such adjustment, the tests shall be repeated for all specified points to ensure compliance.

3.3 ADJUSTING AND CLEANING

A. All equipment furnished under this Section of the Specifications shall be adjusted/calibrated as defined elsewhere this Section/Division.

B. All instruments and equipment shall be left free from shipping stickers, paint splatter, dirt, grease, etc., and shall be clean and in like new condition at final acceptance. Touch-up paint shall be furnished as needed to repair blemishes and scratches in finish paint on panels and enclosures, which shall be corrected by the Contractor.

END OF SECTION 330938

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DIVISION 43

PROCESS GAS AND LIQUID HANDLING, PURIFICATION AND STORAGE EQUIPMENT

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SECTION 434102 - CROSSLINKED POLYETHYLENE CHEMICAL STORAGE TANKS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish, install and place into service all chemical storage tanks and accessories as described in the Drawings and Specifications.

1.2 RELATED WORK

A.	Shop Drawings:	Section 013323
B.	Chemical Feed Equipment:	Sections 463300
C.	Instrumentation:	Division 33
D.	Electrical:	Division 26

1.3 REFERENCES, CODES AND STANDARDS

A. American Society of Testing Materials (ASTM)

1. D638	Tensile Properties of Plastics
2. D883	Standard Definitions of Terms Relating to Plastics
4. D1505	Density of Plastics by the Density-Gradient Technique
5. D1525	Test Method for Vicat Softening Temperature of Plastics
6. D1693	ESCR Specification Thickness 0.125" F50-10% Igepal
7. F412	Standard Terminology Relating to Plastic Piping Systems

B. ANSI Standards: B-16.5, Pipe Flanges and Flanged Fittings

C. Building Code: International Building Code - IBC 2009

D. ARM: Low Temperature Impact Resistance (Falling Dart Test Procedure).

E. NSF/ANSI Standard 61, AWWA – Drinking Water System Components

F. ASTM D-1998, Standard Specification for Polyethylene Upright Storage Tanks

1.4 SUBMITTALS

A. Descriptive literature, product types and materials, design calculations stamped and signed by a Professional Engineer licensed in the State of installation, catalog cuts, dimension drawings, shop drawings, and installation instructions shall be submitted to the Engineer for review before

shipment. The data shown on the shop drawings shall be complete with respect to dimensions, materials of construction and the like, to enable the Engineer to review the information as required. Shop drawing shall comply with the provisions of 013323.

B. At the time of submission, the Contractor shall, in writing, call the Engineer's attention to any deviations that the Drawings may have from the requirements of the Engineer's specifications.

1.5 GENERAL

A. The chemical storage tanks shall be rotationally molded from high-density crosslinked polyethylene with integrally molded flanged outlet (IMFO).

B. The tanks shall have the capacities as required and covers with buttress threads made of polyethylene (no metal). Openings and fittings shall be provided as shown on drawings and described herein.

C. Chemical storage tanks and appurtenances shall be provided to store 12.5% sodium hypochlorite liquid disinfectant having a specific gravity of 1.08 to 1.27 (1.20 average).

1.6 MANUFACTURER'S EXPERIENCE

A. The tank manufacturer shall have been regularly engaged in the design and manufacture of crosslinked polyethylene chemical storage tanks for at least ten (10) years. The manufacturer's experience shall include at least fifteen (15) tank installations, of equal or larger capacities than specified herein, which have been in operation for at least four (4) years. The manufacturer shall submit references for a minimum of five (5) installations where the equipment has been used to store specified chemicals for at least three (3) years.

1.7 GUARANTY

A. The Contractor shall guarantee and warrant that the equipment furnished and installed is free from defects of design, material and workmanship, and will operate satisfactorily. In the event the equipment fails to perform as specified, and after the Owner has given due notice, the Contractor or Supplier, at their own expanse, shall promptly repair or replace the defective equipment without any additional cost to the Owner.

B. The guaranty period shall be as set forth in specification Section 011400, "General Provisions". In the event that the manufacturer's guarantee period exceeds that as stated in the General Provisions, the manufacturer's guarantee period will stay in effect and shall not be replaced by that previously stated.

C. Chemical storage tank manufacturer shall provide a limited 5 year full replacement warranty.

PART 2 - PRODUCTS

2.1 GENERAL

A. Acceptable Products - The chemical storage tanks specified in this section shall be manufactured by Poly Processing Company, or approved equal.

B. The chemical storage tanks provided under this specification shall be constructed of high-density cross linked polyethylene using the rotational molding process with integrally molded flanged outlet (IMFO). Tanks shall be adequately vented for the material, flow and withdrawal rates expected.

C. UL Listing/Classification – The manufacturer shall have a UL structural compatibility listing for vertical aboveground tanks. The UL Listing/Classification shall be in accordance with the Flammable & Combustible Liquids Code, NFPA 30, paragraph 2.2.1 (b) 1, which permits the storage of liquids rated Class IIIB or higher (flammability).

D. UL Listed tanks shall also have UL chemical compatibility listing labels for individual chemicals for which UL testing has been completed.

E. Design wall thickness – The minimum required wall thickness of the cylindrical shell shall be determined per ASTM D1998 (latest version) Section 6.1, Cylinder Shell (unsupported portion of tanks). The maximum design hoop stress used for the wall thickness calculation shall be 600 psi. In no case shall the tank thickness be less than the design requirements per ASTM D1998 (latest version).

F. In applications for the storage of Sodium Hypochlorite, tanks designed for 1.90 specific gravity are required. At the option of Poly Processing Company, the 1.90 specific gravity design can be obtained by tank wall thickness or by the use of a support skirt around the base of the tank. Either of these designs will limit sidewall deflection and add support in the higher stressed areas.

G. The tank supplier must supply as-built wall thickness as well as ASTM D1998 (latest version) required wall thickness.

H. Wall thickness calculations shall assume that tank contents have a specific gravity greater than 1.35 and less than 1.65 for heavy wall thickness. For contents with a specific gravity greater than 1.65, an extra heavy wall is required.

I. Fittings shall be of the type as indicated below for each chemical storage tank application. Fittings shall be PVC with Viton gaskets and flanged or socketed connections as indicated. All materials shall be suitable for continuous immersion in all specified chemicals. No metals shall be exposed to tank contents. All bolts and fasteners shall be constructed of Titanium.

J. All chemical storage tanks shall be manufactured from virgin materials.

K. All chemical storage tanks shall be marked to identify the manufacturer, date of manufacture and serial numbers. All markings shall be permanently embossed into the tanks.

L. High density cross-linked polyethylene resin used in manufacture of the tanks shall be PolyCL or equal and shall contain ultraviolet stabilizer as recommended by the resin manufacturer. Tanks shall be natural in color (un-pigmented).

M. The top and bottom heads of the chemical storage tanks shall be integrally molded with the cylindrical wall. The top's minimum thickness shall be equal to the thickness of the top of the straight sidewall of the tank. Flat areas on the tank top shall be provided for attachment of fittings on the dome of the tank.

2.2 SODIUM HYPOCHLORITE BULK STORAGE TANK

A. Bulk storage tank shall be closed, rotationally-molded, have integrally molded flanged outlet (IMFO), be high density cross-linked polyethylene (HDXLPE), one-piece seamless construction, cylindrical in cross-section and vertical with flat bottom. The tank shall be coated with an oxidation resistant medium-density polyethylene coating on the interior surface of the tank of OR-1,000 or equal. The bulk storage tank shall be of the number and capacities as follows:

1. One (1) bulk storage tank at 3,000 gallons capacity having approximate dimensions of 7'-1" diameter, 12'-0" tall.

B. The bulk storage tank shall have penetrations at the locations shown below and of the required diameters to accommodate the following:

Diameter	Function	Location	Type
24"	Manway	Top	Bolted
3"	Outlet	Bottom Wall	Integrally Molded Flanged Outlet (IMFO)
2"	Fill	Top	Flange Fitting
8"	Vent	Top	Flange Fitting
2"	pH Probe	Top	Flange Fitting
4"	Radar Continuous Level Sensor	Top	Flange Fitting
2"	High Level Alarm Sensor	Top	Flange Fitting
2"	Reverse Float Visual Level Indicator	Top	Flange Fitting
4"	Overflow	Sidewall	Bolted Flange Bulkhead Fitting

C. The bulk storage tank shall have at least three (3) lifting lugs that are designed for lifting the tank when empty.

D. The bulk storage tank shall be provided with a 12 foot access ladder of the type specified hereinafter.

2.3 SODIUM HYPOCHLORITE DAY STORAGE TANKS

A. Day storage tanks shall be closed, rotationally-molded, have integrally molded flanged outlet (IMFO), be high density cross-linked polyethylene (HDXLPE), one-piece seamless construction, cylindrical in cross-section and vertical with flat bottom. The tanks shall be coated with an oxidation resistant medium-density polyethylene coating on the interior surface of the tanks of OR-1,000 or equal. The day storage tanks shall be of the number and capacities as follows:

1. Two (2) day storage tanks at 200 gallons capacity each having approximate dimensions of 2'-7" diameter, 6'- 4" tall.

B. The day storage tanks shall require penetrations at the locations shown below and of the required diameters to accommodate the following:

Diameter	Function	Location	Type
7"	Lid	Top	Threaded and Gasketed
2"	Outlet	Bottom Wall	Integrally Molded Flanged Outlet (IMFO)
2"	Fill	Top	Universal Ball Dome Flange Fitting
3"	Vent	Top	Universal Ball Dome Flange Fitting
4"	Radar Continuous Level Sensor	Top	Made-Vertical Flange Fitting
2"	High Level Alarm Sensor	Top	Universal Ball Dome Flange Fitting
2"	Overflow	Sidewall	Bolted Flange Bulkhead Fitting

2.4 CHEMICAL STORAGE TANK FITTINGS AND ACCESSORIES

A. Integrally Molded Flanged Outlet Fitting

1. All chemical storage tank outlets shall be integrally molded flanged outlets (IMFO). These outlets shall be an integral part of the storage tanks, molded from the same material as the tanks and shall provide complete drainage of liquid through the sidewall of the tanks. Metal and alloy inserts shall not be acceptable.

B. Bolted Flange Fitting

1. Bolted flange fittings shall be constructed of one 150 lb. flange with ANSI bolt pattern, one flange gasket and stud bolts with gaskets. Stud bolts shall have chemical resistant polyethylene injection molded heads and gaskets to provide a sealing surface between the bolt head and the interior tank wall. Flange fittings shall be PVC with Titanium bolts, Viton gaskets and socketed connections.

C. Ladder

1. Fiberglass access ladders shall be provided with the chemical storage tanks at locations indicated. Safety cages shall be added to ladder as required per OSHA.

2. Ladders shall be secured to the tank and secured to the concrete to allow for tank expansion and contraction due to temperature and loading changes. Proper chemical resistant materials shall be used when anchoring the ladder to the tank dome or sidewall. All manufacturer installation instructions shall be followed.

3. Ladders shall be designed to meet applicable OSHA standards. Reference OSHA 2206; 1910.27; fixed ladders.

D. Manway

1. Manways shall be provided on the chemical storage tanks of the size and location as previously indicated. Unless otherwise indicated, manway covers shall be of polyethylene material with a Viton gasket.

E. Reverse Float Visual Level Indicator

1. A reverse float visual level indicator shall be provided where previously indicated and as shown on the Drawings. The level indicator shall be assembled to the tank and shall consist of a PVC float, level indicator, 1/8" diameter yellow twisted polypropylene rope, 4" perforated interior PVC pipe, 4" x 2" PVC reducer, PVC roller guides, clear 2" UV resistant PVC sight tube EnviroKing or equal with 2" cap and necessary pipe supports. The level indicator shall act inversely to the tank contents and shall not allow entrance of the tank contents into the sight tube at any time. Indicator shall be neon orange color for visual ease for onsite operators.

F. Radar Continuous Level Sensor, pH Probe and High Level Alarm Sensor

1. Radar continuous level sensors, pH probes and high level alarm sensors shall be provided at locations previously indicated and as shown on the Drawings. These indicators and sensors shall not be supplied by the chemical storage tank manufacturer and shall be as specified in Divisions 26 and 33 of the specifications.

G. Ball Valve

1. Ball valves shall be provided after the integrally molded flanged outlets on each of the chemical storage tanks as shown on the Drawings. Ball valves shall provide manual shutoff of the outflow from the tanks for maintenance and repairs. Valves shall be PVC with Viton gaskets and Titanium bolts.

H. Expansion Joint

1. Flexible expansion joint shall be provided on the outlet of the bulk chemical storage tank as shown on the Drawings. Expansion joint shall be Flexi-joint or equal and shall be made of 100% virgin PTFE with Viton gaskets and Titanium bolts. Flanges shall be socketed type made of PVC material.

2. Expansion joint shall meet the following minimum performance requirements:

Axial Compression ≥ 0.67”
Axial Extension ≥ 0.67”
Lateral Deflection ≥ 0.51”
Angular Deflection ≥ 14°
Torsional Rotation ≥ 4°

H. Bulk Tank Fill Line

1. A fill line to the bulk tank shall be provided where previously indicated and as shown on the Drawings. The fill line shall be assembled to the tank and shall consist of a 4” x 2” PVC reducer and 2” PVC perforated interior pipe on the inside of the tank from the fill inlet to the bottom of the tank.

2.5 FACTORY TESTING

A. Material Testing

1. Gel and low temperature impact tests shall be performed in accordance with ASTM D 1998 on condition samples cut from each polyethylene chemical storage tank.

2. Method C of ASTM D 1998 - Section11.4 shall be used to determine the ortho-xylene insoluble fraction of cross-linked polyethylene gel test. Samples shall test at no less than 60 percent.

B. Tank Testing

1. Dimensions: Exterior tank dimensions shall be verified with the tank empty, in the vertical position. Outside diameter tolerance, including out-of-roundness, shall be per ASTM D 1998. Fitting placement tolerance shall be +/- 1/2-in vertical and +/- 1 degree radial.

2. Visual: Tanks shall be visually inspected for foreign inclusions, air bubbles, pimples, crazing, and/or cracking.

3. Hydrostatic test: Following fabrication, the bottom of the tanks, including inlet and outlet fittings, shall be hydraulically tested with water by filling to the top sidewall for a minimum of 1 hour and inspecting for leaks. Following successful testing, the tank shall be emptied and cleaned prior to shipment.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

A. The tanks shall be shipped upright or lying down on their sides with blocks and slings to keep them from moving. Tanks shall avoid sharp objects on trailers.

B. All fittings shall be installed and, if necessary, removed for shipping and shipped separately unless otherwise noted by the Contractor.

C. Upon arrival at the destination, tanks and accessories shall be inspected for damage in transit. If damage has occurred, the manufacturer shall be notified immediately.

3.2 COORDINATION OF CONNECTIONS AND EQUIPMENT INSTALLATION

A. Contractor shall coordinate all piping connections by field measurements and/or field installation in order to insure the accuracy of the locations of penetrations of tanks.

3.3 INSTALLATION

A. The chemical storage tanks and their accessories shall be installed in strict accordance with the manufacturer's installation instructions and shop drawings.

B. Installation shall be inspected by the manufacturer to verify system flexible connections, venting and fittings are properly installed. In addition to on-sight inspection, tank system(s) shall be reviewed using tank manual check list as supplied by manufacture.

C. Manufacturer shall a training session to prepare operators to service and maintain the tank system. Included in training session shall be five (5) training manuals.

D. Manufacturer's trained technician shall do an onsite inspection of installation. Inspection shall verify chemical application, plumbing connections, venting, and applicable ancillary equipment such as ladders, restraints, etc. A verification of proper installation certificate shall be supplied when equipment passes installation checklist.

E. Tank manuals shall consist of installation check lists, tank drawing(s) as built, fitting drawings referencing nozzle schedule on tank drawing, materials of construction, and recommended maintenance program.

3.4 FIELD TESTING

A. After installation of tanks and all fittings, the tanks shall be water tested by filling the entire tanks with water and monitoring the tanks as well as all fitting connections for at least seven (7) days. The test shall compensate for the difference in specific gravity between the test water and chemical stored to simulate actual maximum operating pressures. Test methods may include adding a 2.5 psi air pad to a filled tank or filling the tank with standpipes, raising the maximum water surface approximately 5 feet higher than the normal maximum tank level. Any leaks shall be corrected prior to acceptance. Following successful field tank testing, the tanks shall be completely emptied and dried.

END OF SECTION 434102

DIVISION 46

WATER AND WASTEWATER EQUIPMENT

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SECTION 331113 - WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required for furnishing and installing all piping and appurtenances specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Northern Kentucky Water District (NKWD) Standard Specifications and Details as shown on the Contract Drawings. See Sheets C-701 and C-702.

B. Chemical Feed Equipment: Section 463300

1.3 SUBMITTALS

A. A notarized certification shall be furnished for all pipe and fittings that verifies compliance with all applicable specifications.

B. The requirement for this certification does not eliminate the need for shop drawings submittals in compliance with Section 013323.

C. In accordance with the requirements of the General and Special Conditions and this Section, the following table includes, but is not limited to, the items required to be submitted:

Item Description	Shop Drawings	Product Data	Schedules	Installation Data	Parts Lists	Wiring Diagram	Samples	O & M Manual	Certificates	Warranty	Report	Other
Pipe and Fittings		X							X			
Couplings and Adapters		X										
Detectable UG Tape		X		X								
Tracer Wire		X		X								
Corp. Stops and Fittings		X		X								

1.4 EXISTING CONDITIONS

A. The existing piping shown on the Contract Drawings is based on the best available information. The Engineer makes no guarantee as to the accuracy of the locations or type of piping depicted. All new piping which ties into existing lines must be made compatible with that piping.

B. So that piping conflicts may be avoided, Contractor shall open up its trench well ahead of the pipe laying operation to confirm exact locations of existing piping before installing any new piping.

C. Contractor shall provide all fittings and adapters necessary to complete all connections to existing piping.

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

A. See NKWD Standard Drawings 100-B and 100-C on Sheet C-701 for product specifications.

2.2 POLYVINYL CHLORINE (PVC) PLASTIC CHEMICAL FEED CONDUIT

A. PVC Pressure Pipe, 3" and Smaller: Polyvinyl chloride plastic pipe shall be ASTM D 1785 Schedule 80 with solvent weld joints. Fittings shall be ASTM D 2467 Schedule 80 socket type. All socket type connections shall be made with PVC solvent cement complying with ASTM D 2564. PVC solvent cement shall be furnished from the same supplier as the PVC pipe. Provide socket-threaded adapters for connection to threaded appurtenances where required.

2.3 COPPER PIPING

A. Copper piping shall be ASTM B 88 Type K seamless copper water tube, with ANSI B16.18 cast brass solder joint pressure fittings. Provide solder joint-threaded unions at all threaded valves and appurtenances.

2.4 COUPLING AND ADAPTORS

A. Flexible couplings shall be of the sleeve type with a middle ring, two wedge shaped resilient gaskets at each end, two follower rings, and a set of steel trackhead bolts. The middle ring shall be flared at each end to receive the wedge portion of the gaskets. The follower rings shall confine the outer ends of the gaskets, and tightening of the bolts shall cause the follower rings to compress the gaskets against the pipe surface, forming a leak-proof seal. Flexible couplings shall be steel with minimum wall thickness of the middle ring or sleeve installed on pipe being 5/16-inch for pipe smaller than 10 inches, 3/8-inch for pipe 10 inches or larger. The minimum length of the middle ring shall be 5-inches for pipe sizes up to 10 inches and 7 inches for pipe 10 inches to 30 inches. The pipe stop shall be removed. Gaskets shall be suitable for 250 psi pressure rating or at rated working pressure of the connecting pipe. Couplings shall be harnessed and be designed for 250 psi.

B. Flanged adapters shall have one end suitable for bolting to a pipe flange and the other end of flexible coupling similar to that described hereinbefore. All pressure piping with couplings or adapters shall be harnessed with full threaded rods spanning across the couplings or adapters. The adapters shall be furnished with bolts of an approved corrosion resistant steel alloy, extending to the adjacent pipe flanges. Flanges on flanged adapter (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 Class 125.

C. Flexible couplings and flanged adapters shall be as manufactured by Dresser, Rockwell, or equal, per the following, unless otherwise specified and/or noted on the Drawings:

D. Steel couplings for joining same size, plain-end, steel, cast iron, and PVC plastic pipe -

Dresser	Rockwell
Style 138	4ll

E. Transition couplings for joining pipe of different outside diameters-

Dresser	Rockwell
Style 162 (4"-12")	413 steel (2"-24")
Style 62 (2"-24")	415 steel (6"-48")
	433 cast (2"-16")
	435 cast (2"-12")

F. Flanged adapters for joining plain-end pipe to flanged pipe, fittings, valves and equipment.

Dresser	Rockwell
Style 127 cast (3"-12")	912 cast (3"-12")
Style 128 steel (3"-48" C.I. Pipe)	913 steel (3" and larger)
Style 128 steel (2"-96" steel pipe)	

2.5 DETECTABLE UNDERGROUND UTILITY WARNING TAPES

A. Detectable underground utility warning tapes which can be located from the surface by a pipe detector shall be installed directly above nonmetallic (PVC, polyethylene, concrete) pipe.

B. The tape shall consist of a minimum thickness 0.35 mils solid aluminum foil encased in a protective inert plastic jacket that is impervious to all know alkalis, acids, chemical reagents and solvents found in the soil.

C. The minimum overall thickness of the tape shall be 5.5 mils and the width shall not be less than 2" with a minimum unit weight of 2-1/2 pounds/1" x 1,000'. The tape shall be color coded and imprinted with the legend as follows:

Type of Utility	Color Code	Legend
Water	Blue	Caution Buried Water Line Below

D. Detectable underground tape shall be “Detect Tape” as manufactured by Allen Systems, or equal.

E. Installation of detectable tapes shall be per manufacturer's recommendations and shall be as close to the grade as is practical for optimum protection and detectibility. Allow a minimum of 18" between the tape and the line.

F. Payment for detectable tapes shall be included in the linear foot price bid of the appropriate bid item(s) unless it is listed as a separate payment item in the bid schedule.

2.6 TRACER WIRE

A. See NKWD Standard Drawing 100-C on Sheet C-701 for product specifications.

2.7 POLYEHTYLENE WIIRE

A. See NKWD Standard Drawing 100-C on Sheet C-701 for product specifications.

2.8 CONCRETE PIPE ANCHORS, THRUST BLOCKS, CRADLE OR ENCASEMENT

A. Where indicated on the Drawings, required by the Specifications or as directed by the Engineer, concrete pipe anchors, thrust blocks, cradles or encasements shall be installed.

B. Concrete shall be 3000 psi, and reinforcing bars shall be installed as indicated on the details.

2.9 CONNECTION OF NEW WATER MAINS TO EXISTING SYSTEM

A. The Contractor shall connect the new water main to existing water main where shown on the Drawings or directed by the Engineer, and shall furnish all necessary equipment and materials required to complete the connection.

2.10 CORPORATION STOPS AND FITTINGS

A. Corporation stops, of the size required, shall be tapped directly into the water main for Ductile Iron Pipe or by the use of a tapping saddle for PVC pipe.

B. Corporation stops shall have AWWA C800-66 C.S. threaded inlet. Outlets shall be suitable for the type of service piping furnished and laid, and the Contractor shall verify compatibility with "iron pipe size" or "copper tubing size" service piping as required before ordering stops.

C. Corporation stops shall be Ford Type F600, or approved equal.

D. Fittings shall be brass.

2.11 CHEMICAL FEED PULL BOX

A. Polyethylene pull boxes shall be installed at the locations indicated on the Drawings. Pull boxes shall generally be installed above the chemical feed line(s) at all changes in direction.

Boxes shall be 11" long by 18" wide, and shall have polyethylene bodies with ductile iron covers. See specification section 463300 Chemical Feed Equipment for chemical feed line details.

B. Pull boxes shall be Heavy Wall Plastic Meter Boxes by Carson Plastic, Old Castle Precast, Inc., Auburn, WA 98001, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See NKWD Standard Drawings 103 and 103A on Sheet C-503 and Standard Drawings 100-E and 100-F on Sheet C-702 for product installation.

3.2 EXISTING FIRE HYDRANT RELOCATION

A. The installation of the existing relocated fire hydrant shall be per NKWD's Standard Drawing 109 on Sheet C-503 and Drawing 100-F on Sheet C-702.

3.3 CONCRETE THRUST BLOCKS, CRADLE, ANCHORS OR ENCASEMENT

A. Concrete thrust blocks, cradle, anchors or encasement shall be placed where shown on the Drawings, required by the Specifications, or as directed by the Engineer.

B. For cradle and encasement, concrete shall be 3000 psi and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed.

C. For thrust blocks and anchors, concrete shall be 3000 psi, and shall be formed or be sufficiently stiff to maintain the forms indicated on the Details.

D. In tamping concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints. Concrete placed outside the specified limits or without authorization from the Engineer will not be subject to payment.

E. Water mains shall have concrete thrust or "kicker" blocks at all pipe intersections and changes of direction to resist forces acting on the pipeline. All reducers (increasers) shall be anchored.

3.4 BITUMINOUS CONCRETE HIGHWAY, STREET AND DRIVEWAY REPLACEMENT

A. See NKWD Standard Drawing 103-A on Sheet C-503 for product specifications.

3.5 TESTING

A. See NKWD Standard Drawing 100-G on Sheet C-702 for product execution.

3.6 CLEAN UP

A. Upon completion of installation of the piping and appurtenances, the Contractor shall remove all debris and surplus construction materials resulting from the Work. The Contractor shall grade the ground along each side of pipe trenches in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line.

3.7 DISINFECTION OF POTABLE WATER LINES

A. See NKWD Standard Drawings 100-F and 100-G on Sheet C-702 for product specifications.

3.8 SETTLEMENT OF TRENCHES

A. Whenever lines are in, or cross, driveways and streets, the Contractor shall be responsible for any trench settlement which occurs within these rights-of-way within one (1) year from the time of final acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be replaced by the Contractor at no extra cost to the Owner. Repair of settlement damage shall meet the approval of the Owner.

END OF SECTION 331113

SECTION 463300 - CHEMICAL FEED EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish, install and place into service all chemical feed equipment and accessories as described in the Drawings and Specifications.

1.2 RELATED WORK

A.	Shop Drawings:	Section 013323
B.	Fiberglass Reinforced Plastic Products and Fabrications:	Section 107455
C.	Electrical:	Division 26
D.	Instrumentation:	Division 33
E.	Crosslinked Polyethylene Chemical Storage Tanks:	Section 434102

1.3 SUBMITTALS

A. Descriptive literature, product types and materials, catalog cuts, dimension drawings, shop drawings, and installation instructions shall be submitted to the Engineer for review before shipment. The data shown on the shop drawings shall be complete with respect to dimensions, materials of construction and the like, to enable the Engineer to review the information as required. Shop drawing shall comply with the provisions of 013323.

B. At the time of submission, the Contractor shall, in writing, call the Engineer's attention to any deviations that the Drawings may have from the requirements of the Engineer's specifications.

1.4 CHEMICAL FEED SYSTEMS

A. All components of the Chemical Feed Systems shall be mounted in the same configurations as shown on the schematics unless otherwise indicated in the Drawings or Specifications. The systems shall be compatible with each respective chemical and be complete with all appurtenant piping, valves, fittings, equipment, and controls.

B. Refer to Drawings for all locations of chemical feed tap locations.

C. All chemical feed equipment and accessories shall be compatible with and be provided to feed 12.5% sodium hypochlorite liquid disinfectant having a specific gravity of 1.08 to 1.27 (1.20 average).

1.5 GUARANTY

A. The Contractor shall guarantee and warrant that the equipment furnished and installed is free from defects of design, material and workmanship, and will operate satisfactorily. In the event the equipment fails to perform as specified, and after the Owner has given due notice, the Contractor or Supplier, at their own expanse, shall promptly repair or replace the defective equipment without any additional cost to the Owner.

B. The guaranty period shall be as set forth in specification Section 007200, "General Conditions". In the event that the manufacturer's guarantee period for any product exceeds that as stated in the General Conditions, the manufacturer's guarantee period will stay in effect and shall not be replaced by that previously stated.

PART 2 - PRODUCTS

2.1 CHEMICAL METERING PUMPS

A. General

1. Description

a. Pumps shall be positive displacement peristaltic type complete with spring-loaded pumphead, self-contained variable speed drive, and flexible extruded tube as specified.

b. Peristaltic pumping action is created by the compression of the flexible tube between the pumphead 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.

c. 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' vertical water column. Maximum pressure rating shall be 30 psi.

d. 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.

e. Flow shall be in the direction of the rotor rotation, which can be reversed and shall be proportional to rotor speed.

f. Metering pumps shall be model 520DuN/R2 as manufactured by Watson Marlow Inc., Wilmington, MA, or Engineer approved equal.

2. Quality Assurance

a. This specification is the basis for design of peristaltic metering pumps. All pumps, whether named as an acceptable supplier or submitted as an equal must, at a minimum, meet the following critical design requirements.

b. To maximize pump efficiency and minimize tube fatigue that will impact life, performance, and accuracy, pumps shall be designed not to exceed the specified P/10 ratio (Theoretical maximum number of occlusions per 10 gallons pumped). Pumps exceeding the specified P/10 ratio, will not be considered suitable for the duty condition. The following criteria is set to maintain the P/10 of ratio for the tube size specified for this application:

1. Maximum two compressing rollers for two compressions per revolution.
2. Tube wall thickness of 2.4 mm and material specified
3. Large diameter spring-loaded roller set for 2.4mm wall thickness tubing
4. Max base drive speed of 220 RPM for 2.4mm wall thickness tubing.
5. Track geometry of no less than 180 degrees and rotor geometry with roller 180 degrees apart.

c. P/10 ratio shall not exceed the following per tube size:

Tube Size	P/10 ratio
1.6mm x 2.4mm	181,820
3.2mm x 2.4mm	45,460
4.8mm x 2.4mm	20,840
6.4mm x 2.4mm	11,570
8.0mm x 2.4mm	7,170
9.6mm x 2.4mm	4,960

d. For quality assurance, all pump tubing shall be manufactured by the pump manufacturer in accordance with their specifications. Tubing not manufactured by the pump manufacturer will not be acceptable.

e. Drive and pumpheads shall be 24 hour continuous duty rated and have a five-year manufacturer's warranty from date of shipment.

f. Pumps shall be manufacturer's standard product. Manufacturer of tubing pumps shall 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 service and size as specified.

g. Pumps shall be manufactured under ISO 9001-2000.

h. Pumps shall be meet all applicable CE and C ETL US standards per UL610101A.

B. Pump Design

1. Pump Process Schedule

a. Metering pumps shall be supplied according to the following schedule.

Quantity	Four (4) pumps total
Feed Location	Two (2) pumps designated for each feed train (one pump for backup)
Model Number	520DuN/R2
Fluid to be Pumped	12.5% Sodium Hypochlorite
Tubing Material	Marprene II
Max – Min Capacity (GPH)	0.02 – 52.3 gph
Tubing ID	9.6mm (3/8")
Displacement /Revolution (Gallons)	0.0040
Displacement /Revolution (Milliliters)	15.14
P10 Ratio (Theoretical Maximum Number of Occlusions/10 Gallons Pumped)	4,960
Min Flow Rate (GPH)	0.0242
Max Flow Rate (GPH)	53.26
Min Flow Rate (Ml/Min)	1.50
Max Flow Rate (Ml/Min)	3300
Max Discharge Pressure (psi)	20 psi
Suction Head	6 ft of Suction Lift to 1 ft of Suction Head
Power (VAC, Frequency, Phase)	115VAC, 60 Hz, 1 Phase

2. Pump Construction

a. Pumphead

1. Pumphead shall consist of a fixed track, a hinged guard door, two spring-loaded tube clamp mechanisms, and spring-loaded roller rotor assembly. 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. Tube occlusion and spring tension shall be factory set to accommodate 2.4mm wall thickness tubing and shall not require adjustment for accommodating tubing of 1.6mm to 9.6mm ID.

2. 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.

a. Pumphead Assembly

1. Pump Track Geometry shall have a minimum 96.6mm swept diameter through a minimum track angle of 180 degrees.

2. High corrosion/impact materials shall be provided as specified below
   a) Track Construction: polyphenylene sulfide (PPS)
   b) Guard Construction: hinged impact-resistant polycarbonate breakaway guard, tool un-lockable for operator safety.
   c) Rotor Construction: polyphenylene sulfide (PPS)

b. Tube Retainer Mechanism
   1. Two spring–loaded adjustable tube retainer mechanisms shall be provided to secure the tubing at the entry and exit points of the pumphead.

c. Rotor Assembly

   1. Rotor assembly shall be provided that ensures gradual tube occlusion and compensates for tube tolerance:

      a) Twin spring-loaded roller arms located 180 degrees apart, each fitted with stainless steel helical springs and compressing roller for occlusion of the tube twice per rotor revolution.

         1) Compressing Rollers: 316SS with low friction stainless steel bearings and PTFE seals, minimum diameter of 18mm

      b) Non-compressing guide rollers constructed of corrosion resistant Nylatron shall be provided.

   2) Rotor shall be equipped with a central handgrip hub and manually activated clutch to disengage the rotor from the drive for manual rotor rotation during tube loading. Clutch shall automatically reengage rotor to gearbox upon one complete revolution.

   3) To prevent slip, the rotor assembly shall be axially secured to the dogged output shaft of the gearmotor via a slotted collet and central retaining screw.

   4) Pumpheads requiring disassembly or special tools for tube changing are not acceptable.

b. Tubing

   1. Pump tubing shall be in contact with the inside diameter of the track (housing) through an angle of 180 degrees and be held in place on the suction and discharge by tube retainer clamps. The tubing shall be replaceable without the use of tools and with no disassembly of the pumphead. To achieve maximum flow per revolution, pump heads with a track angle of less then 180 degrees are not acceptable.

   2. Pump tubing shall be constructed of Marprene II, a thermoplastic elastomer with a 64 Shore A durometer and 2.4mm wall thickness. Pump manufacturer shall manufacture Marprene tubing in-house. Pump manufacturers who purchase third party tubing are not acceptable.

   3. Pump shall readily accept tubing ID's of 1.6mm, 3.2mm, 4.8mm, 6.4mm, 8.0mm or 9.6mm without pump adjustment or replacement. Tubing with a wall thickness less then 2.4mm is not acceptable.

   4. A 15-meter roll of specified tubing size shall be provided with each pump.

5. Hose barb-to-process line adaptors shall be supplied by the Contractor for connection of pump tubing to process lines. Hose barbs shall be secured to the pump tubing via a hose clamp tightened around the OD of the tubing.

c. Drive

1. Drive shall be rated for continuous 24 hour operation, at 40^{o} C ambient.

2. Supply: 110-120V 50/60 Hz and 220-240V 50/60 Hz, 1-Phase field switchable. Nine-foot length mains power cord with standard 115V three-prong plugs shall be provided.

3. Max drive power consumption: 135VA.

4. Enclosure: NEMA 4X

5. Housing: Pressure cast aluminum with Alocrom pre-treatment and exterior grade corrosion resistant polyester powder coat. By nature of the environmental conditions, unpainted housings, including 316SS, are not acceptable.

6. Pumps must meet the following minimum requirements for operator interface functionality. Pumps not meeting this minimum functionality will not be accepted.

a. 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.

b. Keypad for start, stop, speed increment, speed decrement, forward/reverse direction, rapid prime, and programming.

c. Menu driven on screen programming of manual or auto control, flow and remote signal calibration, and general programming.

d. Programmable "Auto Restart" feature to resume pump status in the event of power outage interruption.

e. Programmable "Keypad Lock" to allow operator lockout of all keys except emergency start/stop.

f. Programmable "Maximum Speed" to allow operator to set the maximum speed of the pump within 0.1-220 rpm.

7. Auto control features shall be supplied to meet the following minimum functionality requirements. Pumps not meeting this minimum functionality will not be accepted.

a. Remote Control Inputs

1. Speed Control:

   a) Primary Analog 4-20mA or 0-10VDC speed input, with input signal trimmable and speed scaleable over any part of the drive speed range.

   b) Secondary Analog 4-20mA or 0-10VDC scaling input, with input signal trimmable and programmable scaling factor.

   c) Provisions for alternative remote accessory potentiometer (if supplied by others) for primary speed control or secondary speed scaling.

2. Start/Stop Control: via 5V TTL, 24V industrial logic or dry contact- Configurable command sense allowing open to equal run or open to equal stopped.

3. Forward/Reverse Control: via 5V TTL, 24V industrial logic or dry contact.

4. Auto/Man Mode Control: via 5V TTL, 24V industrial logic or dry contact.

5. Leak Detector Run/Stop Control: via 5V TTL, 24V industrial logic, or dry contact.

b. Status Outputs

   1. Four relay contacts rated for a 30 VDC with a maximum load of 30W, NO or NC software configurable to indicate the following:

      a) Running/Stopped status
      b) Forward/Reverse status
      c) Auto/Manual status
      d) General Alarm status
      e) Leak Detected status

   2. Speed output – Analog 4-20mA or 0-10 VDC

c. Accepts RS485 data protocol.

d. Termination: screw down terminals suitable for up to18 AWG field wire and accessible through four glanded cable entry points on the pump shall be supplied.

8. Drive motor shall be brushless DC motor with integral gearbox and tachometer feedback.

   a. Speed Control Range shall be 2200:1 from 0.1 to 220 rpm +/- 0.1 rpm throughout the range.

b. Closed loop microprocessor controlled drive with pulse width modulation at speeds above 35 rpm and synchronous mode with magnetic field rotation control below 35 rpm.

c. Circuitry complete with temperature and load compensation and protection.

9. Mounting: Drive shall be self-supporting and shall not require anchoring.

10. Leak Detection- Pump manufacturer shall supply float-type leak sensor mounted to below the pump head for leak detection and pump shut down in the event of a tubing failure

11. Spares: One spare pump head assembly shall be supplied.

2.2 CHEMICAL TRANSFER PUMPS

Addendum No. 1 *(4/27/15)*

A. Chemical transfer pumps shall be of the centrifugal end-suction, seal-less magnetic drive type. Rotation of the impeller shall be accomplished by a magnetic motor assembly having no motor shaft or shaft seals.

B. The transfer pumps shall be of PVDF construction with viton ring and Teflon impeller bushing for chemical resistance.

C. The pumps shall have 1-inch diameter flanged inlet and outlet connections.

D. The pump motors shall be 1/2 HP, TEFC and operate at 460 volts, 3 phase, 60 Hertz.

E. One transfer pump shall be installed for each chemical feed train. Each pump shall be rated to operate at 34 gpm at 16 feet of TDH and at 38 gpm at 7.5 feet of TDH. The pump impellers shall have the correct trim to be able to accommodate these design points.

F. Transfer pumps shall be Model DB6H as manufactured by Finish Thompson, Inc., Erie, PA, or Engineer approved equal. Manufacturer shall provide a five (5) year warranty on the transfer pumps.

~~A. Chemical transfer pumps shall be of the centrifugal end-suction, seal-less magnetic drive type. Rotation of the impeller shall be accomplished by a magnetic motor assembly having no motor shaft or shaft seals.~~

~~B. The transfer pumps shall be of PVDF construction with viton ring and Teflon impeller bushing for chemical resistance.~~

~~C. The pumps shall have 1-inch diameter flanged inlet and outlet connections.~~

~~D. The pump motors shall be 1/3 HP, TEFC and operate at 460 volts, 3 phase, 60 Hertz.~~

~~E. One transfer pump shall be installed for each chemical feed train. Each pump shall be rated to operate at 33.5 gpm at 15.5 feet of TDH and at 38.5 gpm at 7.8 feet of TDH. The pump impellers shall have the correct trim to be able to accommodate these design points.~~

~~F. Transfer pumps shall be Model DB6 as manufactured by Finish Thompson, Inc., Erie, PA, or Engineer approved equal. Manufacturer shall provide a five (5) year warranty on the transfer pumps.~~

2.3 CHEMICAL FEED DISCHARGE TUBING

A. Chemical feed discharge piping after the metering pumps shall be clear braid reinforced flexible PVC tubing with standard wall thickness and shall be installed in a PVC conduit. Two 3/8-inch diameter flexible PVC tubing chemical feed lines (one for backup) shall be installed inside one 2-inch PVC conduit where shown on the Drawings for each feed train.

B. All chemical feed tubing shall be either clear or translucent and come in a continuous roll of minimum 100 foot lengths.

C. Chemical feed flexible tubing connections to PVC hard piping shall be made utilizing barbed by NPT threaded polypropylene fittings tapped into PVC caps on the ends of the PVC hard piping. Flexible tubing shall be retained on the barbed fittings using black nylon "Kwik Clamps".

D. Flexible tubing, barbed fittings and "Kwik Clamps" shall be as manufactured by New Age Industries, Southampton, PA, or Engineer approved equal.

2.4 CHEMICAL METERING PUMP TUBING

A. Chemical metering pump tubing from the metering pump suction headers, through the metering pumps, to the chemical feed discharge piping shall be flexible tubing of Marprene for chemical resistance. Metering pump tubing shall be manufactured and supplied by the metering pump manufacturer. See section 2.1.B.2.b hereinbefore.

2.5 CHEMICAL FEED PIPING

A. Piping from the bulk storage tank to the transfer pumps, from the transfer pumps to the day storage tanks, and from the day tanks the metering pump flexible tubing shall be PVC plastic pressure pipe.

B. Polyvinyl chloride plastic pressure pipe, 3-inch and smaller, shall be ASTM D 1785 Schedule 80 with solvent weld joints. Fittings shall be ASTM D 2467 Schedule 80 socket type. All socket type connections shall be made with PVC solvent cement complying with ASTM D 2564. PVC solvent cement shall be furnished from the same supplier as the PVC pipe. Provide socket-threaded adapters for connection to threaded appurtenances where required. Threaded connections shall be minimized.

C. All socket type connections shall be made with chemical-resistant solvent cement formulated for chemical applications. Product shall be Weld-On 724 by IPS Corporation, EP42 by Oatey, or approved equal.

2.6 CHEMICAL FEED VALVES

A. Ball Valves

1. Unless otherwise noted, small diameter plastic (PVC) ball valves (shut-off valves) shall be Chemtrol TU Series 150 psi socketed true union ball valves as manufactured by Chemtrol Industrial Products NIBCO, Inc., Louisville, Kentucky; Hayward Manufacturing Co., Inc., Elizabeth, New Jersey; or Engineer approved equal, and NSF listed for potable water.

2. Ball valves shall be vented and installed so indicator arrow is in the direction of flow. All gaskets shall be Viton material. Unless otherwise noted on the Drawings, fasten and run wire or chain through valve handle to enable operation from floor, where applicable.

B. Ball Check Valves

1. Small diameter plastic (PVC) check valves shall be Chemtrol BC Series 150 psi socketed true union ball check type as manufactured by Chemtrol Industrial Products NIBCO, Inc., Louisville, Kentucky; Hayward Manufacturing Co., Inc., Elizabeth, New Jersey; or Engineer approved equal, and NSF listed for potable water. All gaskets shall be viton material

2.7 CHEMICAL INJECTION ASSEMBLIES

A. Where chemicals are to be fed into process piping as shown on the Drawings, the Contractor shall furnish and install chemical injection assemblies. Chemical injection assemblies shall be constructed of brass and PVC and include corporation stop, ball check valve, safety limit chain, quick release coupling and solution tube.

B. The chemical injection assemblies shall be retractable and be provided with a 3/4-inch male NPT connection tapped into the process piping. The assembly shall be provided complete with a 1/2-inch male NPT adapter for inlet connection, a brass corporation stop, a spring loaded ball check valve, stainless steel limit chains, brass ball valve, PVC quick release coupling, and a 3/8” inch PVC solution tube. Seals shall be made if Viton. The insertion tube shall have an insertion length of 6-inches.

C. The chemical injection assemblies shall be model number EB-125 as manufactured by SAF-T-FLO, Anaheim, CA, or Engineer approved equal.

2.8 CHEMICAL FEED ACCESSORIES

A. Pressure Relief Valve

1. A pressure relief valve shall be installed on the discharge piping of each peristaltic metering pump. The pressure relief valve line shall be piped to the respective pump suction line. The diaphragm in the pressure relief valve shall operate to relieve pressure in the chemical feed piping when the pressure exceeds the preset pressure of the valve. Installation shall be made as close to the pumps as possible without any valves or accessories between the pressure relief valve and the pumps. Pressure relief vales shall be PVC with viton gaskets and socketed connections.

B. Calibration Column

1. A calibration column shall be installed on the suction side of the peristaltic metering pumps for each feed train. The calibration columns shall be constructed of material suitable for use with sodium hypochlorite. The calibration columns shall be translucent with graduated marks so the Operator can measure quantities of chemical being pumped by the metering pump.

C. FRP Pump Stand

1. Chemical metering pumps shall be mounted to a wall-mounted fiberglass reinforced plastic (FRP) pump stand.

D. Overflow Check Valve

1. Duckbill type check valves shall be installed on the end of each chemical storage tank overflow line as indicated on the Drawings. Overflow check valves shall be constructed of viton elastomer and shall be Series TF-1 as manufactured by Tideflex, Carnegie, PA, or Engineer approved equal.

E. Cam Operated Couplings

1. Cam operated couplings shall be of the type and size, and installed at the locations indicated on the Drawings. Cam adaptors and caps shall be polypropylene and shall be manufactured by New Age Industries, Southampton, PA, or Engineer approved equal.

2.10 FRP PIPE SUPPORTS AND HANGERS

A. The Contractor shall furnish and install all FRP pipe hangers, inserts, brackets, plates, anchors, and other supports not specifically included under other items above. Generally pipe supports are not shown on the Drawings, but shall be supplied to facilitate installation requirements. However, any bracing or support details shown on the Drawings shall be followed. FRP Pipe support systems, including anchoring hardware, shall be chemical and corrosion resistant to the chemical in which it is serving.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The chemical feed equipment and accessories shall be installed in strict accordance with each manufacturers' installation instructions and shop drawings.

B. All plastic pipe or tubing shall be adequately supported and braced. Support spacing shall not exceed the recommendations of the Plastics Pipe Institute.

C. Materials shall be new and of the best grade and quality; workmanship shall be first class in every respect.

D. Piping shall be installed straight and true, parallel or perpendicular to walls, with approved offsets around obstructions. Standard pipe fittings shall be used for changing direction of piping. No mitered joints or field fabricated pipe bends are permitted unless accepted by the Engineer.

E. All materials and equipment shall be clean and free of oil, grease and/or chemical contaminants prior to installation.

3.2 TECHNICAL ASSISTANCE

A. The Contractor shall furnish the services of an experienced and qualified manufacturer's technician to supervise installation and start up of the Chemical Feed Systems as specified herein and shown on the Drawings. In addition, the manufacturer's technician shall instruct the plant operating personnel in the operation and maintenance of the Chemical Feed Systems.

END OF SECTION 463300

APPENDIX A

GEOTECHNICAL EXPLORATION REPORT

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GEOTECHNICAL EXPLORATION REPORT

SODIUM HYPOCHLORITE BUILDING

NKWD DUDLEY COMPLEX

EDGEWOOD, KENTUCKY

Prepared for: **GRW Engineers, Inc.**

Thelen Project No.: **140820E**

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October 28, 2014

GRW Engineers, Inc.
801 Corporate Drive
Lexington, Kentucky 40503

Attention: Mr. Alan Bryan

Re: Geotechnical Exploration Report
Sodium Hypochlorite Building
NKWD Dudley Complex
Edgewood, Kentucky

Ladies and Gentlemen:

Submitted herein are the results of the geotechnical exploration completed for the proposed Sodium Hypochlorite Building at the Northern Kentucky Water District Dudley Complex in Edgewood, Kentucky. Our services were performed in accordance with our Subcontract Agreement with GRW Engineers, Inc., dated September 15, 2014.

This report presents the results of test borings to explore the subsurface conditions, laboratory testing, engineering analyses, and the development of recommendations for site development and foundation design for the proposed building. Additionally, we have included in the Appendix to this report a reprint of "Important Information about Your Geotechnical Engineering Report" published by ASFE, Professional Firms Practicing in the Geosciences, which our firm would like to introduce to you at this time.

We appreciate the opportunity to provide the geotechnical consulting services for this project. If you have any questions regarding the contents of this report, or if we may be of any additional service to you, please do not hesitate to contact us.

Respectfully submitted,
THELEN ASSOCIATES, INC.

Akshat Saxena, E.I.
Staff Geotechnical Engineer

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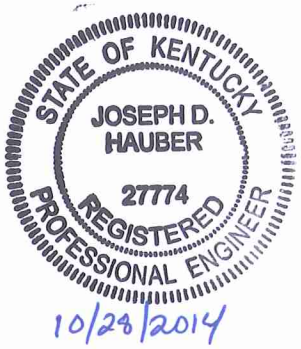

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140820E

Copies submitted: GRW Engineers, Inc. (2 mail / email)

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GEOTECHNICAL EXPLORATION REPORT

SODIUM HYPCHLORITE BUILDING

NKWD DUDLEY COMPLEX

EDGEWOOD, KENTUCKY

1.0 INTRODUCTION

Presented in this report are the results of the geotechnical exploration completed for the proposed Sodium Hypochlorite Building at the Northern Kentucky Water District (NKWD) Dudley Complex in Edgewood, Kentucky. The main purposes of this exploration were to determine the general subsurface profile at the site and to relate the engineering properties of the soils to the site development and foundation design for the proposed building. Our services included test borings, laboratory testing, engineering analyses, and preparation of this report.

2.0 PROJECT DESCRIPTION

The project description below for the proposed Sodium Hypochlorite Building project at the NKWD Dudley Complex was derived from Exhibit A of the NKWD Professional Services Agreement, dated August 4, 2014 and from the Proposed Floor Plan and Section that were prepared by GRW and dated October 2014. All elevations noted in this report are referenced to Mean Sea Level Elevation (MSL).

The proposed Sodium Hypochlorite Building is part of a renovation of the existing Sodium Hypochlorite System at the Dudley Complex. The existing Sodium Hypochlorite System consists of two 1,500-gallon bulk tanks, three transfer pumps, two day tanks,

three metering pumps, and associated piping and valves. This entire system is housed in two separate buildings and the proposed Sodium Hypochlorite Building will house all tanks and equipment in one new building.

We understand that the proposed building will contain a 3,000-gallon bulk storage tank, two day tanks, two transfer pumps, and other associated hardware and piping. The finished floor elevation of the proposed building will be El. 828.5 feet at the entrance to the building and step down to El. 825.5 feet. Consequently, there will minimal cut and fill (less than 2 feet) involved.

Grading for the proposed building will be relatively minimal with cuts and fills on the order of 2 to 5 feet.

We understand that the proposed buildings will be a concrete-block structure with a brick veneer supported on shallow foundations. We understand that the wall loads will be on the order of 7.5 kips per foot, and maximum column loads will be on the order of 20 kips.

3.0 SUBSURFACE EXPLORATION

The fieldwork phase of this exploration was carried out on September 29, 2014. Two (2) test borings, numbered 1 and 2, were performed for the proposed building. The locations of the test borings are shown on our Boring Plan, Drawing 140820E-1, in the Appendix of this report. Test boring locations were selected, staked, and surveyed by GRW; the MSL elevations are provided on the test boring logs included in the Appendix to this report.

The test borings were drilled with a track-mounted drill rig advancing hollow stem augers. Sampling was accomplished ahead of the augers with a 2-inch outside diameter (O.D.) standard split spoon sampler in general accordance with the procedures outlined by ASTM D1586. Representative portions of the split spoon samples were placed in labeled glass jars to preserve the in situ moisture contents of the samples for laboratory review and testing. As each test boring was advanced, the

Drilling Technician kept a field log of the subsurface profile noting the soil and bedrock types and stratifications, the presence or absence of groundwater, standard penetration test results, and other pertinent data.

4.0 LABORATORY TESTING AND REVIEW

The samples from the exploratory test borings were examined and visually classified in the laboratory by the Project Geotechnical Engineer. Representative samples were selected for moisture content determinations and Atterberg limits tests. The results of these tests are included in the Tabulation of Laboratory Tests in the Appendix to this report.

Final test boring logs were prepared by the Project Geotechnical Engineer on the basis of the visual classification in the laboratory, the laboratory test results, and the field logs kept by the Drilling Technician. Copies of the test boring logs are included in the Appendix along with Soil and Rock Classification Sheets, which describe the terms and symbols used on the boring logs. The dashed lines on these test boring logs indicate an approximate change in soil or bedrock strata as estimated between samples. A solid line indicates the change in strata occurred within a sample where a more precise measurement could be made. Furthermore, the transition between soil and bedrock types can be abrupt or gradual.

5.0 GENERAL TERRAIN, SUBSURFACE, AND GEOLOGIC CONDITIONS

Test Borings 1 and 2 indicate the presence of existing cohesive fill overlying native clays (classified as glacial soils) in the area of the proposed building. These were followed by residual soils and the bedrock formation, which consists of interbedded shale and limestone, and was encountered at varying depths from the existing ground surface.

5.1 Geologic Strata

5.1.1 Existing Fill

Existing fill was encountered at the ground surface in both of the test borings. The fill encountered in the test borings was 2 feet thick and consisted of silty clay with trace organics and topsoil. The consistency of the fill was stiff to very stiff in these test borings.

The Standard Penetration Test Values (N-values) [1] for the fill in Test Borings 1 and 2 were 9 and 7 blows per foot (bpf), respectively. Natural moisture contents of two (2) samples of fill were 22.9 percent and 18.1 percent.

5.1.2 Native Clays

Native clays were encountered beneath the fill in both test borings; the thicknesses ranged from 5 to 10 feet. The native clays were described as brown and mottled brown with trace oxide stains, concretions, trace roots, and trace shale and limestone fragments/floaters. The consistency of the native clays varied from very stiff to hard.

The N-values for the native clay ranged from 8 to 25 bpf. Natural moisture content testing on six (6) samples of native clays yielded values ranging from 19.4 percent to 31.8 percent. Two samples of the native clays were classified as CH soils (i.e., soils with high plasticity) according to the Unified Soil Classification System (USCS) with liquid limits of 58 percent in Test Boring 1 and 61 percent in Test Boring 2, and respective plasticity indices of 31 and 33 percent.

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[1] The Standard Penetration Test Value, or N-value, is defined as the number of blows required to drive the split spoon sampler 12 inches with a 140-pound hammer falling 30 inches. Since the split spoon sampler is driven 18 inches or until refusal, the blows for the first 6 inches are for seating the sampler and the number of blows for the final 12 inches is the N-value. Additionally, “refusal” of the split spoon occurs when the sampler is driven less than 6 inches with 50 or more blows of the hammer.

5.1.3 Residual Soils

Residual silty clays (or residuum) were encountered beneath the existing fill and native clays in both test borings. The thickness of the residual soils in both borings was 2.5 feet. These soils are typically termed residual because they have weathered in place over time from the underlying parent bedrock. These residual soils were described as brown with trace gray, moist silty clays with traces of bedding planes, and limestone floaters/layers. The consistency of the residual soils encountered was predominantly very stiff to hard.

The N-values for the residual soils were 30 and 71 bpf in Test Borings 2 and 1, respectively. The natural moisture contents of two tested residual soil samples were 17.9 and 18.7 percent.

5.1.4 Shale and Limestone Bedrock

The overburden soils at the site are underlain by bedrock consisting of interbedded shale and limestone layers. The depth to the upper boundary of bedrock from the existing ground surface was 14.5 feet in Test Boring 1 and 9.5 feet in Test Boring 2.

Bedrock in the Northern Kentucky Area is typically categorized by the degree of weathering of the shale component as highly weathered, weathered, or unweathered. The highly weathered zone is typically the uppermost zone, wherein the shale is brown to olive brown in color and has almost weathered to a clay. In the intermediate weathered zone, the shale is typically olive brown with occasional gray and is stronger than the shale in the highly weathered zone. In the unweathered parent zone, the shale is gray and is stronger than the shale in the weathered zones. It is not uncommon for any combination of the weathered shale bedrock zones to be absent at any location due to differential weathering, erosion, or prior excavation. The Rock Classification Sheet, which is included in the Appendix of this report, describes the varying degrees of weathering along with the rock strength descriptions that are used on the appended boring logs.

Regarding the limestone, these layers are predominantly unweathered, and their strengths are estimated to range from medium strong to very strong (i.e., uniaxial compressive strengths ranging from 4,000 psi to upwards of 30,000 psi). Occasionally, thin layers are encountered within the bedrock profile where groundwater seepage is concentrated and weathering of the limestone layers is more advanced.

Interbedded highly weathered shale and limestone bedrock was encountered in Test Borings 1 and 2 at respective depths of 14.5 and 9.5 feet. The strength of the highly weathered shale was described as extremely weak. . Natural moisture content testing of one (1) highly weathered shale sample yielded a value of 18.8 percent.

Interbedded weathered shale and limestone bedrock was encountered in Test Borings 1 and 2 at respective depths of 17.0 and 14.5 feet. The strength of the highly weathered shale was described as extremely weak.

Interbedded unweathered shale and limestone bedrock was not encountered within the depths penetrated in Test Borings 1 and 2 before the test borings were terminated at a depth of 18.1 feet.

5.1.4.1 USGS Bedrock Geology Map Information

According to the USGS Bedrock Geology Maps of the Covington Quadrangle in Kentucky (1971), the bedrock immediately underlying the overburden soils across the project site belongs to the either the Bullfork Formation, the Bellevue Tongue of the Grant Lake Limestone, or the Fairview Formation, which are listed in order of decreasing elevation. The contact between the upper two bedrock formations is approximately at El. 820 feet while the contact between the Bellevue Tongue and the Fairview Formation is approximately at El. 810.

The Bullfork Formation is described as consisting of more than 50 percent limestone, with the remaining percentage consisting of shale and minor siltstone interbeds. The limestone is described as fine- to coarse-grained argillaceous limestone or rubbly limestone similar to the underlying Bellevue Tongue of the Grant Lake Limestone. The

limestone is irregularly to evenly bedded with beds typically less than 4 inches thick, but locally as thick as 12 inches. The shale and siltstone are commonly calcareous and thinly bedded to laminated.

The Bellevue Tongue of the Grant Lake Limestone is described as shelly, rubbly limestone with fossils in an argillaceous matrix. The limestone beds are described as thin, highly irregular, and lenticular. Very thin and discontinuous shale partings are also noted to be present in this bedrock formation.

The Fairview Formation is described as consisting of 45 to 60 percent shale, with the remaining percentage consisting of limestone. The shale is laminated to thinly bedded, commonly fissile, and slightly calcareous with localized encounters of fossils. The limestone is described as predominantly fine- to coarse-grained bioclastic limestone, or fine- to coarse-grained argillaceous, shelly, and rubbly limestone. The limestone is also generally encountered in beds that are irregularly to evenly layered. The limestone beds are noted as typically less than 4 inches thick, but locally as thick as 15 inches.

5.2 Groundwater Conditions

Groundwater measurements were made in the test borings during drilling, at the completion of drilling, and immediately before backfilling the test boring holes. Groundwater measurement notes are included at the bottoms of the test boring logs in the Appendix.

Based on our local experience, groundwater seepage is anticipated to occur at the fill/native soil interface, soil/bedrock interface, and along limestone layers within the bedrock, even though groundwater was not encountered in any of the test borings. Locally concentrated flow may occur along fractures within the bedrock or within saturated zones of overburden soils that were not encountered by the borings. Groundwater levels and seepage/flow rates are expected to vary with time, location, and amounts of precipitation.

6.0 SEISMICITY

Based on the borings and our interpretation of the 2013 Edition of the Kentucky Building Code, it is our opinion that a seismic site class of C is applicable for the project site.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 General

Based upon the test borings, a visual examination of the samples, the laboratory tests, our understanding of the proposed building, and our experience as Consulting Soil and Foundation Engineers in Northern Kentucky, we have reached the following conclusions and make the recommendations in this report.

The conclusions and recommendations of this report have been derived by relating the general principles of the discipline of Geotechnical Engineering to the proposed construction outlined in Section 2.0 of this report. Because changes in surface, subsurface, climatic, and economic conditions can occur with time and location, we recommend for our mutual interest that the use of this report be restricted to this specific project.

Our understanding of the proposed design and construction is based on the documents provided to us at the time that this report was prepared, which are referenced in Section 2.0 of this report. We recommend that our office be retained to review the final design documents, plans, and specifications, to assess any impact changes, additions, or revisions in these documents may have on the conclusions and recommendations of this Geotechnical Report. Any changes or modifications which are made in the field during the construction phase that alter site grading, structure locations, infrastructure, or other related site work should also be reviewed by our office prior to their implementation.

If conditions are encountered in the field during construction that vary from the facts of this report, we recommend that our office be contacted immediately to review the changed conditions in the field and make appropriate recommendations. It is our

understanding that the timeframe for beginning and completing the site work for this project will be continuous without interruption or delay. Should interruptions or delays occur, our office should be kept appraised to modify recommendations accordingly.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air, on or below or around this site.

We have performed the test borings and laboratory tests for our evaluation of the site conditions and for the formulation of the conclusions and recommendations of this report. We assume no responsibility for the interpretation or extrapolation of the data by others.

The earthwork recommendations of this report presume that the earthwork will be monitored continuously by an Engineering Technician under the direction of a Registered Professional Geotechnical Engineer. We recommend that the Owner contract these services directly with Thelen Associates, Inc.

We recommend that a preconstruction meeting be held at the site with the Owner's representative, the Design Civil Engineer, the Architect, the Structural Engineer, the General Contractor, the Excavating Contractor, the Geotechnical Engineer, and any other interested parties to review the scope and schedule of the proposed earthwork and foundation installation.

In general, it is our opinion that the site is suitable for the proposed earthwork and new building provided that the recommendations contained herein are implemented relative to site preparation, earthwork operations, and foundation design.

7.2 Excavation Support

Excavation support should be the responsibility of the Contractor. All excavation support should be designed and implemented such that the excavations are adequately braced, shored, sloped, and ventilated in order to protect and ensure the safety of

workers within and near the excavations and to protect all adjacent ground, slopes, structures, and infrastructure. All federal, state, and local safety regulations should be satisfied along with OSHA regulations. The analyses, discussions, conclusions, and recommendations throughout this report are not to be interpreted as pre-engineering compliance with OSHA regulations or any other safety regulations.

7.3 Site Preparation and Earthwork Operations

7.3.1 General

Earthwork for this proposed building will include minimal cuts and fill (less than 2 feet in thickness).

The initial preparation of the site for grading should include the removal of all vegetation, root systems, topsoil, and pavement from the construction area. The topsoil may be stockpiled for future use on the completed cut and fill slopes or in landscaped areas, if permitted by the specifications. All concrete, rubble, and debris associated with the pavements should be wasted off site.

Following the above-mentioned site preparation, the exposed subgrade should be thoroughly proofrolled using a heavy piece of on-site equipment under the review of the Project Geotechnical Engineer, or a representative thereof. If any soft or yielding soils are observed during the proofrolling operations, they should be undercut to firm, non-yielding material at the direction of the Engineer, or representative thereof.

We recommend that fill materials consist of approved on-site or borrow silty clay or clay soils, relatively free of topsoil, vegetation, trash, construction or demolition debris, sedimentary soils, frozen materials, particles over 6 inches in maximum thickness, or other deleterious materials.

We recommend that the fill within a 2H:1V outward and downward projection from the finished floor of the proposed building be compacted to at least 98 percent of the standard Proctor maximum dry density, ASTM D698. All other fill at the site should be

compacted to at least 95 percent of the standard Proctor maximum dry density, ASTM D698, unless noted otherwise. The fill should be placed in shallow level layers, 6 to 8 inches in thickness, and each layer should be moisture-conditioned to within 2 percent below to 3 percent above the optimum moisture content for compaction, unless noted otherwise. Each lift of clayey fill should be thoroughly compacted with a sheepsfoot roller or self-propelled sheepsfoot compactor to the recommended degree of compaction, as previously mentioned.

Most of the compacted fill will be placed on sloping terrain. In these areas, the fill should be placed on continuous horizontal benches up the sloping terrain with the initial bench having a minimum width of 15 feet and all subsequent benches being at least 5 feet wide. The initial 15-foot wide bench should be located at the toe of the proposed fill. The benching operations should remove all surficial low-density soils and expose stiff native soils. These benches should not be made until the fill is ready to be placed, and the fill materials and placement of fill should be consistent with the previous recommendations in this section. If any groundwater seepage is noted on the benches, the Project Geotechnical Engineer should be contacted for underdrainage recommendations before the soils are replaced and compacted.

We recommend that the permanent fill slopes for this project be designed not steeper than 2.5H:1V. Gentler slopes should be used whenever possible for ease of maintenance. Additionally, we recommend that all fill slopes be slightly overbuilt and then trimmed back to the design slope to achieve a well-compacted surface.

Groundwater is not expected to have a significant adverse effect on the proposed earthwork construction; however, the Contractor must be prepared to remove seepage that accumulates during excavation on fill surfaces or at subgrade levels.

We recommend that the earthwork operations be carried out during the dry season of the year and that a sufficient gradient be maintained at the ground surface to prevent ponding of surface water. Experience has found that the optimum season of the year for earthwork in Northern Kentucky is during the months of May through October

because of the historically more favorable weather conditions during that period. If any of the work is undertaken during the Winter or early Spring months, it is recommended that care be taken that no asphalt, concrete, or fill is placed over frozen or saturated soils. Additionally, frozen or saturated soils should not be used as compacted fill or backfill.

It is very important to maintain the moisture content of the bearing and subgrade soils for all footings and floors during and after construction for the proposed building. The clayey subgrade soils should not be allowed to become excessively wet or dried during or after construction. Measures should be taken to prevent water from ponding on the subgrades and to prevent subgrades from desiccating during dry weather.

It is very important that good, positive drainage be established around the proposed building to promote the rapid drainage of surface water away from the building and to prevent the ponding of water adjacent to it. Positive drainage away from the structure is all the more important due to the presence of highly plastic soils encountered in the test borings. Finish grading in grass and landscaped areas should be sloped down and away from the building at 10 percent for at least 10 feet, and then at a gradient of at least 2 percent beyond the initial 10 feet from the building. All potential pavements should drain away from the building at a minimum of 2 percent. The final grades should direct the surface water to storm water collection systems.

Additionally, deep-rooted vegetation in the proximity of building foundations can extract moisture from plastic and low plasticity soils alike, causing them to shrink, which can cause building settlement issues. Consequently, deep-rooted vegetation should not be planted within 1.5 times their projected mature foliage radius from foundations. Additionally, smaller bushes or flowerbeds adjacent to the proposed structures should not be watered by ponding water in the beds where the bushes or flowers may be growing, which could lead to swelling of the foundation soils and heave.

Appropriate measures and/or best management practices (BMPs) should be implemented to minimize: 1) the effects of erosion and 2) the siltation of adjacent

properties. Upon completion of earthwork, disturbed areas should be appropriately stabilized.

7.4 Foundations

We recommend that the proposed building be supported on shallow foundations, i.e., continuous wall footings, isolated column pads, and/or mat foundations, bearing in the stiff to hard native clayey soils or new engineered fill. An allowable bearing pressure of 3,000 pounds per square foot (psf) can be used for the stiff to hard native clayey soils, as well as the new engineered fill. We recommend that continuous wall footings be at least 16 inches wide and isolated column footings be at least 24 inches square.

The test borings indicate the presence of highly plastic clays at design bearing elevation. Highly plastic clays have a significant potential for shrinking and swelling due to changes in moisture content. Foundations with relatively low bearing pressures in these plastic soils can undergo foundation movement when there are changes in the moisture content of the soil. Consequently, we recommend that all exterior foundations bear a minimum of 42 inches below proposed exterior grades, which is 12 inches below the nominal 30-inch frost depth in Northern Kentucky, and interior foundations should bear at least 12 inches below subgrade elevation. If the proposed building will be constructed with a mat foundation in lieu of continuous wall footings and isolated column pads, the bottom of the mat foundation only needs to bear a minimum of 30 inches below proposed exterior grades. .

We recommend that all foundation excavations be cut to neat lines and grades so that concrete may be placed directly against the banks of the excavations without forming. If a mat foundation is used, it should be cast over a concrete mud mat as is subsequently discussed and not over a granular base. All loose, soft, wet, frozen, or otherwise disturbed materials should be removed from the bearings surfaces of the foundations prior to the placement of reinforcing steel and concrete. If a crusted or saturated surface develops at the bearing surface for any foundation, we recommend that the surface be skimmed to expose a fresh surface before reinforcing steel or concrete is

placed. Foundation concrete should be placed the same day as the excavation to prevent saturation or desiccation of the plastic soils on site.

Concrete mud mats may be placed over the bearing surfaces to protect the bearing materials from desiccation, softening via saturation, or swelling problems from water ponding. If a mat foundation is used to support the proposed building, we recommend that a concrete mud mat be placed across the entire footprint of the mat foundation to protect the plastic soils at subgrade. If these concrete mud mats are utilized, the concrete should have a minimum compressive strength of 1,500 psi, a maximum permeability of $5x10^{-5}$ centimeters per second, and a minimum thickness of 3 inches. Also, the excavated bearing surface should be lowered at least the thickness of the mud mat, and the top of the mud mat should be at or below the design bearing elevation. Prior to the placement of the concrete mud mat, the bearing surfaces should be cleaned of loose, soft, wet, frozen, or otherwise disturbed material.

Ponded water should not be allowed to collect within footing excavations on top of either bearing soils or bedrock in order to mitigate any potential softening or swelling problems.

The bearing elevations for foundations should not be located higher than a relationship of 2H:1V above proposed adjacent foundations or the inverts of nearby existing or proposed, paralleling or nearly paralleling utilities without a site specific evaluation of the conditions by the Project Geotechnical Engineer.

We recommend that foundation steps have a maximum height of 2 feet and a corresponding minimum length of 4 feet. Reinforcing steel and concrete should remain continuous through the foundation steps.

We recommend that all foundation excavations be reviewed by the Project Geotechnical Engineer, or representative thereof, prior to placing reinforcing steel and concrete in order to determine if the exposed bearing materials and surfaces are consistent with the design recommendations of this report.

7.5 Foundation Walls

The foundation walls should be designed to resist unbalanced lateral earth pressures due to the backfill, plus any appropriate surcharges for pavement loads, sloping backfill, etc. We recommend that lateral earth pressures be calculated based on the equivalent fluid weights presented in Table 1. Table 1 includes recommended earth pressure coefficients for calculating surcharge pressures. Unless a site-specific analysis is performed, we recommend that surcharges be modeled as a uniform horizontal pressure equal to the vertical intensity of the surcharge multiplied by the recommended earth pressure coefficient in Table 1.

The values provided in Table 1 are based on a soil unit weight (γ) of 125 pounds per cubic foot (pcf), a soil internal angle of friction (ϕ) of 26 degrees, a level ground surface behind the wall, and the use of a drainage system behind the wall to prevent hydrostatic pressures.

Table 1. Recommend drained equivalent fluid weights to calculate lateral earth pressures.

	Active	At-Rest
Lateral Earth Pressure Coefficient, K:	0.39	0.56
Equivalent Fluid Weight, EFW (pcf):	48.8	70.2

The decision to use active or at-rest earth pressures should be based upon the ability of the wall or structure to deflect as a result of the lateral earth pressures, which will depend on how the top of the wall is connected to the floor slabs. In cohesive clayey backfill, the minimum deflection at the top of the wall for active earth pressures to develop is 0.02 times the height of the wall. If these minimum horizontal deflections at the top of the wall are not attained, at-rest earth pressures are applicable.

For the equivalent fluid weights of Table 1 to be applicable, a drainage system must be incorporated along the backfilled face of the wall consisting of a prefabricated drainage board or an approximately 18-inch width of free-draining gravel with less than 3 percent fines wrapped with a non-woven drainage geotextile. At the base of the drainage board

or free-draining gravel should be a minimum 12-inch-thick and 12-inch-wide gravel zone surrounding a 4-inch-diameter rigid perforated plastic pipe, all of which wrapped in a non-woven drainage geotextile. The plastic pipe should be connected to a suitable gravity outlet. All granular backfill should be compacted to at least 75 percent relative density per ASTM D4253 and D4254. We recommend that the drainage system extend to within 2 feet of finished grade and be capped with at least 2 feet of compacted clayey soils to minimize the infiltration of surface water behind the wall. Any clayey backfill should be compacted to at least 95 percent of the standard Proctor maximum dry density, ASTM D698. The drainage system should not connect to any interior drainage system below the floor slab, which should have a separate, independent outlet.

Resistance to lateral loads can be developed by friction at the bottom of the wall footing, using an ultimate friction value of 0.35. Below frost depth, passive resistance against stiff native soils, bedrock, or stiff compacted and tested fill can be developed using an allowable uniform passive pressure distribution of 2,000 psf for concrete cast neat against vertical surfaces.

Additionally, along the south (rear) wall of the proposed building, a subwall designed for at-rest earth pressures could be considered in lieu of grading a slope to establish the subgrade of the building.

7.6 Backfill

We recommend that all foundation excavations and utility trenches within the perimeters of the proposed building, surrounding sidewalks, and pavements be backfilled with flowable fill or compacted clayey soils up to design subgrade elevation. The flowable fill and the compacted clayey soils will minimize water from collecting in these excavations or trenches, which could potentially be absorbed by the surrounding clays, causing heave of foundations, slabs, pavements, etc., and softening of these soils. We recommend that the flowable fill have a maximum permeability of 10^{-5} centimeters per

second and have design strength of at least 30 psi for stability and not greater than 100 psi for future excavatability.

For all other utility excavations, the trenches should be backfilled with compacted and tested clay soils or granular soils that are placed in shallow level layers, 6 to 8 inches in thickness. If clay soils are used, they should be compacted to at least 95 percent of the standard Proctor maximum density, ASTM D698, and moisture-conditioned to within 2 percent below to 3 percent above the optimum moisture content for compaction. If granular soils are used, they should be limited to pipe bedding and the minimum required pipe/utility cover, and should be compacted to at least 75 percent relative density per ASTM D4253 and ASTM D4254. Under no conditions should any backfill be flushed in an attempt to obtain compaction.

Prior to placing the bedding and utilities within the utility trench, all soft, saturated, and compressible material should be removed from the bottom of the trench exposing moist stiff soils or undisturbed bedrock.

7.7 Floor Slab

This section of the report is not applicable if the floor slab for the proposed sodium hypochlorite building is being designed as a mat foundation. If the floor slab is being designed as a mat foundation, refer to Section 7.4 of this report.

We anticipate that the floor slabs for the buildings will be designed as slab-on-grade concrete. The concrete floor slab thicknesses should be designed based on the native or compacted and tested, stiff soils at this site providing a modulus of subgrade reaction (k) of 75 pounds per cubic inch (pci).

We recommend that the top 8 inches of clayey subgrade be compacted to at least 98 percent of the standard Proctor maximum density, ASTM D698, at moisture contents within 2 percent of optimum. We also recommend that a granular blanket consisting of at least 4 inches of free-draining gravel be used over the subgrade beneath the ground floor slab to allow for the dissipation of water vapor. The granular base should be

compacted with vibratory equipment to densities not less than 75 percent relative density per ASTM D4253 and ASTM D4254. We recommend that the utmost care be implemented during construction so that the subgrade will not become desiccated or saturated.

We also recommend that the compacted clay subgrade be uniformly slope and shaped to drain at a minimum 2-percent gradient toward an interior perforated rigid PVC collection pipe connected to an appropriate gravity outlet. The outlet should be separate and independent from the outlet for any exterior drainage systems (e.g., the foundation wall drainage system recommended in Section 7.5). The recommend granulate blanket over the subgrade will allow for the collection of water in addition to the dissipation of water vapor.

It is recommended that control joints be provided within the concrete slab-on-grade floors. Said joints should then be sealed to mitigate surface water infiltration. We recommend that the ground floor slab be structurally separated from all walls, columns, footings, and penetrations to allow independent movement of the floor.

APPENDIX

ASFE Report Information

Test Boring Logs 1 and 2

Soil Classification Sheet

Rock Classification Sheet

Tabulation of Laboratory Tests

Boring Plan, Drawing 140820E-1 (In Pocket)

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you —* should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

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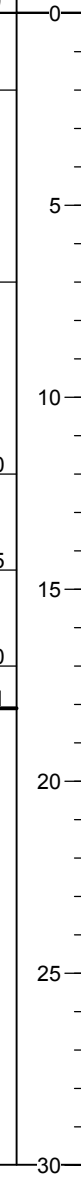
LOG OF TEST BORING

CLIENT: GRW Engineers, Inc.
BORING #: 1
PROJECT: Geotechnical Exploration, Sodium Hypochlorite Building
NKWD Dudley Complex, Edgewood, Kentucky
PROJECT #: 140820E
PAGE #: 1 of 1
LOCATION OF BORING: As shown on Boring Plan, Drawing 140820E-1

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Sample Condition	Sample Number	Sample Type	SPT* Blows/6" / Rock Core RQD (%)	Recovery (in.)	Recovery (%)
828.2	Ground Surface	0.0						
	Mixed brown moist very stiff FILL, silty clay, trace organics and topsoil.		I	1	DS	2-4-5	18	100
826.2		2.0						
	Brown moist very stiff CLAY, trace organics, trace concretions (glacial) (CH).		I	2	DS	6-9-9	18	100
			I	3	DS	6-7-6	18	100
821.2		7.0						
	Mottled brown moist very stiff to hard CLAY, trace concretions, trace shale fragments, limestone floaters/fragments (glacial).		I	4	DS	7-10-15	15	83
			I	5	DS	5-4-4	18	100
816.2		12.0						
	Brown moist very stiff to hard SILTY CLAY, trace bedding planes, trace to little limestone floaters/layers (residuum).		I	6	DS	9-21-50	18	100
813.7		14.5						
	Interbedded brown moist extremely weak highly weathered SHALE and gray medium strong to very strong LIMESTONE (bedrock).		I	7	DS	38-50/3"	9	100
811.2		17.0						
810.1	Interbedded brown moist extremely weak, trace very weak weathered SHALE and gray medium strong to very strong LIMESTONE (bedrock).	18.1	I	8	DS	48-50/1"	7	100
	Split spoon refusal and bottom of test boring at 18.1 feet.							



Datum: Mean Sea Level
Surface Elevation: 828.2 ft.
Date Started: 9/29/2014
Date Completed: 9/29/2014
Hammer Weight: 140 lb.
Hammer Drop: 30 in.
Pipe Size: 2 in. O.D.
Hole Diameter: 8 in.
Rock Core Diameter: --
Boring Method: HSA-3.25
Drill Rig: CME-55 TD-3
Foreman: J. Franz
Engineer: A. Saxena

BORING METHOD
HSA = Hollow Stem Augers
CFA = Continuous Flight Augers
DC = Driving Casing
MD = Mud Drilling

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
DS = Driven Split Spoon
PT = Pressed Shelby Tube
RC = Rock Core

SAMPLE CONDITIONS
D = Disintegrated
I = Intact
U = Undisturbed
L = Lost

GROUNDWATER DEPTH
First Noted: None
At Completion: Dry
After: --
Backfilled: Immediately

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

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LOG OF TEST BORING

CLIENT: GRW Engineers, Inc.
BORING #: 2
PROJECT: Geotechnical Exploration, Sodium Hypochlorite Building
NKWD Dudley Complex, Edgewood, Kentucky
PROJECT #: 140820E
PAGE #: 1 of 1
LOCATION OF BORING: As shown on Boring Plan, Drawing 140820E-1

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Condition	Sample Number	Sample Type	SPT* Blows/6" / Rock Core RQD (%)	Recovery (in.)	Recovery (%)
824.2	Ground Surface	0.0	0						
822.2	Mixed brown moist stiff FILL, silty clay, trace organics and topsoil.	2.0		I	1	DS	2-4-3	18	100
	Brown moist hard CLAY, trace oxide concretions, trace limestone fragments (glacial) (CH).			I	2	DS	8-11-13	18	100
			5	I	3	DS	8-9-9	18	100
817.2		7.0							
814.7	Brown, trace gray moist very stiff SILTY CLAY, bedding planes and limestone floaters/layers (residuum).	9.5		I	4	DS	5-8-22	18	100
	Interbedded brown moist extremely weak highly weathered SHALE and gray medium strong to very strong LIMESTONE (bedrock).		10	I	5	DS	16-29-50	18	100
				I	6	DS	34-35-50/5"	15	88
809.7		14.5							
	Interbedded gray, trace brown moist extremely weak slightly weathered SHALE and gray medium strong to very strong LIMESTONE (bedrock).		15	I	7	DS	50/6"	6	100
806.1		18.1		I	8	DS	26-50/1"	7	100
	Split spoon refusal and bottom of test boring at 18.1 feet.		20						
			25						
			30						

Datum: Mean Sea Level
Surface Elevation: 824.2 ft.
Date Started: 9/29/2014
Date Completed: 9/29/2014
Hammer Weight: 140 lb.
Hammer Drop: 30 in.
Pipe Size: 2 in. O.D.
Hole Diameter: 8 in.
Rock Core Diameter: --
Boring Method: HSA-3.25
Drill Rig: CME-55 TD-3
Foreman: J. Franz
Engineer: A. Saxena

BORING METHOD
HSA = Hollow Stem Augers
CFA = Continuous Flight Augers
DC = Driving Casing
MD = Mud Drilling

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
DS = Driven Split Spoon
PT = Pressed Shelby Tube
RC = Rock Core

SAMPLE CONDITIONS
D = Disintegrated
I = Intact
U = Undisturbed
L = Lost

GROUNDWATER DEPTH
First Noted: None
At Completion: Dry
After: --
Backfilled: Immediately

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

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SOIL CLASSIFICATION SHEET

NON COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

Density

Very Loose	- 5 blows/ft. or less
Loose	- 6 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft.
Very Dense	- 51 blows/ft. or more

Relative Properties

Descriptive Term	Percent
Trace	1 – 10
Little	11 – 20
Some	21 – 35
And	36 – 50

Particle Size Identification

Boulders	- 8 inch diameter or more	
Cobbles	- 3 to 8 inch diameter	
Gravel	- Coarse	- 3/4 to 3 inches
	- Fine	- 3/16 to 3/4 inches
Sand	- Coarse	- 2mm to 5mm (dia. of pencil lead)
	- Medium	- 0.45mm to 2mm (dia. of broom straw)
	- Fine	- 0.075mm to 0.45mm (dia. of human hair)
Silt		- 0.005mm to 0.075mm (Cannot see particles)

COHESIVE SOILS
(Clay, Silt and Combinations)

Consistency	Field Identification	Unconfined Compressive Strength (tons/sq. ft.)
Very Soft	Easily penetrated several inches by fist	Less than 0.25
Soft	Easily penetrated several inches by thumb	0.25 – 0.5
Medium Stiff	Can be penetrated several inches by thumb with moderate effort	0.5 – 1.0
Stiff	Readily indented by thumb but penetrated only with great effort	1.0 – 2.0
Very Stiff	Readily indented by thumbnail	2.0 – 4.0
Hard	Indented with difficulty by thumbnail	Over 4.0

Classification on logs are made by visual inspection.

Standard Penetration Test – Driving a 2.0" O.D., 1 3/8" I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. It is customary to drive the spoon 6 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6 inches of penetration on the drill log (Example – 6/8/9). The standard penetration test results can be obtained by adding the last two figures (i.e. 8+9=17 blows/ft.). Refusal is defined as greater than 50 blows for 6 inches or less penetration.

Strata Changes – In the column "Soil Descriptions" on the drill log, the horizontal lines represent strata changes. A solid line (————) represents an actually observed change; a dashed line (— — — —) represents an estimated change.

Groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

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ROCK CLASSIFICATION SHEET

ROCK WEATHERING

Descriptions	Field Identification
Unweathered	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than it its fresh condition.
Highly Weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Residual Soil	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact with bedding planes visible, and the soil has not been significantly transported.

ROCK STRENGTH

Descriptions	Field Identification	Uniaxial Compressive Strength (psi)
Extremely Weak	Indented by thumbnail	40-150
Very Weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife.	150-700
Weak	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.	700-4,000
Medium Strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single blow of a geological hammer.	4,000-7,000
Strong	Specimen requires more than one blow of a geological hammer to fracture.	7,000-15,000
Very Strong	Specimen requires many blows with a geological hammer to fracture.	15,000-36,000
Extremely Strong	Specimen can only be chipped with geological hammer.	>36,000

BEDDING

Descriptive Term	Bed Thickness
Massive	> 4 ft.
Thick	2 to 4 ft.
Medium	2 in. to 2 ft.
Thin	< 2 in.

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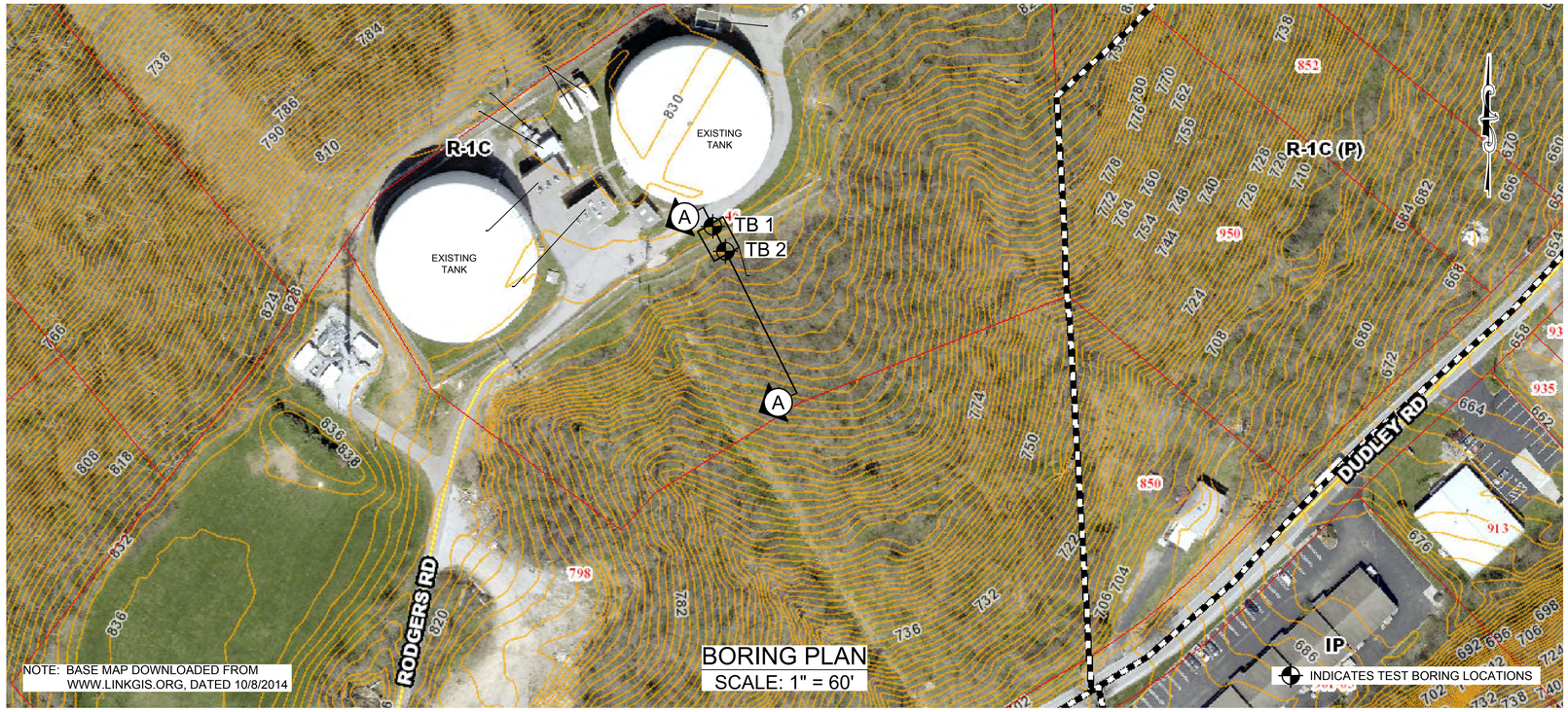
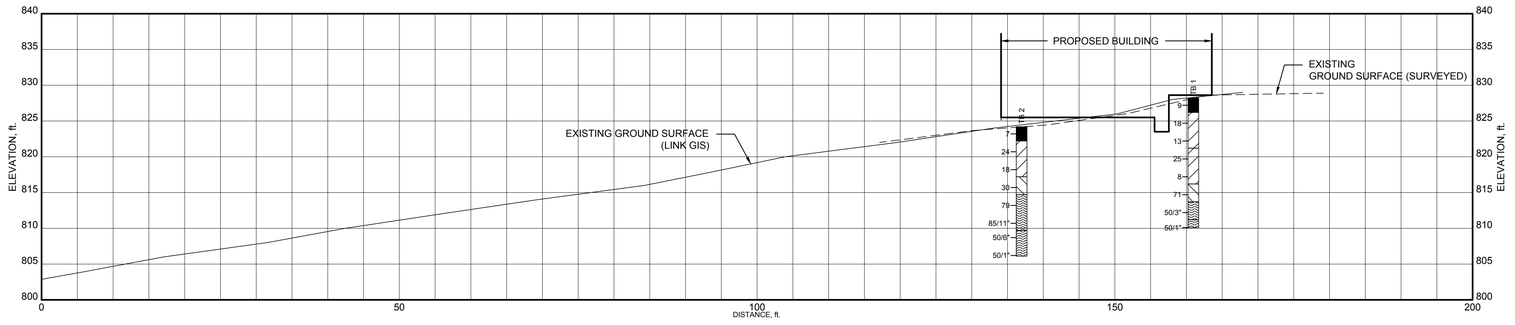
GEOTECHNICAL EXPLORATION
SODIUM HYPOCHLORITE BUILDING
NKWD DUDLEY COMPLEX
EDGEWOOD, KENTUCKY
140820E

TABULATION OF LABORATORY TESTS

Boring Number	Sample Number	Depth, ft.		Moisture Content, %	Atterberg Limits, %			USCS Classification
		From	To		LL	PL	PI	
B-1	1	0.0	1.5	22.9				
	2	2.5	4.0	19.4				
	3	5.0	6.5	23.7	58	27	31	CH
	4	7.5	9.0	21.7				
	5	10.0	11.5	31.8				
	6	12.5	14.0	17.9				
B-2	1	0.0	1.5	18.1				
	2	2.5	5.0	23.9	61	28	33	CH
	3	5.0	6.5	27.9				
	4	7.5	9.0	18.7				
	5	10.0	11.5	18.8				



BORING PLAN
SCALE: 1" = 60'



LEGEND

FILL | CLAY | SILTY CLAY | HIGHLY WEATHERED SHALE AND LIMESTONE BEDROCK | WEATHERED SHALE AND LIMESTONE BEDROCK

CROSS-SECTION A-A
SCALE: 1" = 10'

Drawing Revisions

Date:	Description:

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Title: BORING PLAN & CROSS-SECTION A-A

Client: GRW Engineers, Inc.

Project: Geotechnical Exploration
NKWD Sodium Hypochlorite Building
NKWD Dudley Complex

Location: Edgewood, Kentucky

Scale: AS NOTED

Date: 10/28/2014

Drawing No.: 140820E-1

APPENDIX B

ADDENDUM'S ONE and TWO

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ADDENDUM NO. 1

NORTHERN KENTUCKY WATER DISTRICT
DUDLEY COMPLEX SODIUM HYPOCHLORITE BUILDING
CITY OF EDGEWOOD, KENTUCKY

GRW PROJECT NO. 4325

April 27, 2015

SPECIFICATIONS:

1. **Specification Section 011410 Special Provisions Part 1, 1.4:** [Replace section 1.4 in its entirety with the following.]

   1.4 START-UP AND OWNER TRAINING

   After each piece of equipment is successfully started-up, training shall be administered on each piece of equipment by the particular piece of equipment's factory Representative. O&M Manuals shall be reviewed and approved by Owner and Engineer before startup and training. Complete payment for a piece of equipment shall not be made until an O&M manual is submitted and approved, the piece of equipment is successfully started up, and the owner is satisfactorily trained.

2. **Specification Section 463300 Chemical Feed Equipment Part 2, 2.2:** [Replace section 2.2 in its entirety with the following.]

   2.2 CHEMICAL TRANSFER PUMPS

   A. Chemical transfer pumps shall be of the centrifugal end-suction, seal-less magnetic drive type. Rotation of the impeller shall be accomplished by a magnetic motor assembly having no motor shaft or shaft seals.

   B. The transfer pumps shall be of PVDF construction with viton ring and Teflon impeller bushing for chemical resistance.

   C. The pumps shall have 1-inch diameter flanged inlet and outlet connections.

   D. The pump motors shall be 1/2 HP, TEFC and operate at 460 volts, 3 phase, 60 Hertz.

   E. One transfer pump shall be installed for each chemical feed train. Each pump shall be rated to operate at 34 gpm at 16 feet of TDH and at 38 gpm at 7.5 feet of TDH. The pump impellers shall have the correct trim to be able to accommodate these design points.

   F. Transfer pumps shall be Model DB6H as manufactured by Finish Thompson, Inc., Erie, PA, or Engineer approved equal. Manufacturer shall provide a five (5) year warranty on the transfer pumps.

3. **Specification Section 223300 Electric, Domestic Water Heaters Part 2, 2.2.B:** [Delete paragraph 2.2.B in its entirety.]

4. **SCADA HMI Programming**

   All references in the Contract Specifications related to SCADA HMI programming shall be accomplished by the Northern Kentucky Water District.

DRAWINGS:

1. **SHEET M-101 Mechanical Plan** [Replace Remark #1 note below the Domestic Water Heaters schedule in its entirety with the following.]

   REMARKS:
   1. DESIGN BASIS: KELECH SNA SERIES

2. **SHEET M-101 Mechanical Plan** [Add the following Accessories note below the Domestic Water Heaters schedule for the following items 1-8 to be included with the heater.]

   ACCESSORIES:
   1. STACK LIGHT WITH DISTRIBUTED CONTROL SYSTEM LINK
   2. INTERNAL FUSED DISCONNECT
   3. GROUND FAULT PACKAGE
   4. ASME HEAT EXCHANGER
   5. NEMA 4X ENCLOSURE – STAINLESS STEEL
   6. COMBINATION PRESSURE AND TEMPERATURE RELIEF VALVE
   7. Y-PATTERN STAINLESS STEEL STRAINER
   8. FLOOR MOUNTED CABINET ENCLOSURE

CLARIFICATIONS AND QUESTIONS:

1. **Temporary Fence During Construction**

   Temporary fence shall be installed during construction where existing fence is removed prior to installation of permanent fencing. Specification section 323113 Chain Link Security Fences and Gates shall be followed for temporary fence material and installation except that fence posts are not required to be installed in concrete footings.

2. **Chemical Feed Vault Access Hatch**

   Access hatch for the chemical feed vaults shall be of the angle frame type and reference to the odor resistant gasket is not required.

3. **Q:** Drawing E-601 sheet note #3 does not agree with the symbol shown in the MCC. Please confirm that a 3 pole 150 amp breaker is all that is needed and what does the interrupting rating of the breaker need to be?
   A: Yes, a 150A/3P thermal-magnetic breaker, 42KAIC, is required.

4. **Q:** Regarding specification section 262416 Panelboards, is a stainless steel enclosure an acceptable equal to a NEMA 4X FRP enclosure?
   A: No. Enclosures shall be NEMA 4X FRP.

5. **Q:** Specification section 260533 Raceways sections 2.2 E and 3.2 A 7 indicate Type UA flexible conduit is to be used for motor connections or a piece of equipment subject to vibration. What type of connector is to be used in the Sodium Hypochlorite Building?
   A: Please utilize non-metallic liquidtight flexible conduit with non-metallic connector for connection to equipment subject to vibration (i.e. transfer pumps).

6. **Q:** Can schedule 80 PVC electrical conduit be installed in the Sodium Hypochlorite building concrete slab?
   A: Yes.

7. **Q:** Specification section 264313 Surge Protective Devices calls out a NEMA1 rating. These are to be installed in the Sodium Hypochlorite Building. Is this the correct NEMA rating?
   A: No, the surge protective device shall be NEMA 4X enclosed.

8. **Q:** Specification section 330933 Instruments section 2.1 A 5c references a Gauge Schedule in specification section 330930.06. This schedule cannot be located. Please clarify.
   A: The correct specification reference to Gauge Schedule in 330933, Part 2.1.A.5.c should be 330937, Part 1.6.

9. **Q:** According to Square D, the maximum height of their fiber glass enclosures are limited to 50''.
   A 42 circuit panel will not fit in the 50'' max enclosure only a 30 circuit. Therefore is a 30 circuit panel acceptable in lieu of a 42 circuit panel?
   A: Yes, a 30 circuit panelboard is acceptable in lieu of a 42 space panelboard.

10. **Q:** Will water pipes be taken out of service to perform taps or do all taps needs to be performed while the line is in service.
    A: No, the existing water lines will not be taken out of service. All taps to be wet taps.

11. **Q:** Is the Contractor responsible to write the Storm Water Erosion plan, apply for and pay for the permit?
    A: Yes. See Specification section 312500 Erosion and Sedimentation Control.

12. **Q:** Regarding Specification section 011410 Special Provisions, can the requirement for videotaping trainings be waived?
    A: Yes. See revision to Specification section 011410 Special Provisions above.

13. **Q:** Regarding Specification section 315000 Excavation Support and Protection, is the intent of this section to require the Contractor to install a shoring system to protect the existing driveway immediately north of the new Chemical Building?
    A: Specification section 315000 Excavation Support and Protection is provided to give guidance for chosen means of construction.

14. **Q:** Referring to Sheet C-101, Is NKWD taping the existing 6" water main and providing the pipe and water meter? The Contractor would then start the 1 ¼" copper line to the west side of the water meter.
    A: New water meter to be installed inside the new Sodium Hypochlorite Building shall be provided and installed by the Contractor. See Sheet M-101. Contractor shall tap existing 16" waterline and install new 1 ¼" copper service line to the new Sodium Hypochlorite Building.

15. **Q:** Referring to Sheet C-102, excavation for the north side of the chemical building will require the road to the back of the facility to be closed. Will this be a problem?
A: Any road closures shall be coordinated with the Owner. The Owner will need access to the bulk chemical storage tanks located in the existing building at the rear of the Dudley Complex.

GRW ENGINEERS, INC.

Adalyn Haney

Adalyn Haney, P.E.
Project Engineer

Attachments:
Plan Holder's List

ADDENDUM NO. 2

NORTHERN KENTUCKY WATER DISTRICT
DUDLEY COMPLEX SODIUM HYPOCHLORITE BUILDING
CITY OF EDGEWOOD, KENTUCKY

GRW PROJECT NO. 4325

April 28, 2015

CLARIFICATIONS AND QUESTIONS:

1. **Handrails, Grating and Support Structures**

   All references to aluminum handrails, grating and support structures on drawing details shown on Sheet S-501 shall be revised to indicate FRP construction. FRP products shall be designed and provided in accordance with specification section 107455 Fiberglass Reinforced Plastic Products and Fabrications.

2. **Roof Framing**

   Provide pre-engineered wood trusses and dimensional lumber for roof framing as indicated on structural Sheet S-101.

GRW ENGINEERS, INC.

Adalyn Haney

Adalyn Haney, P.E.
Project Engineer

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